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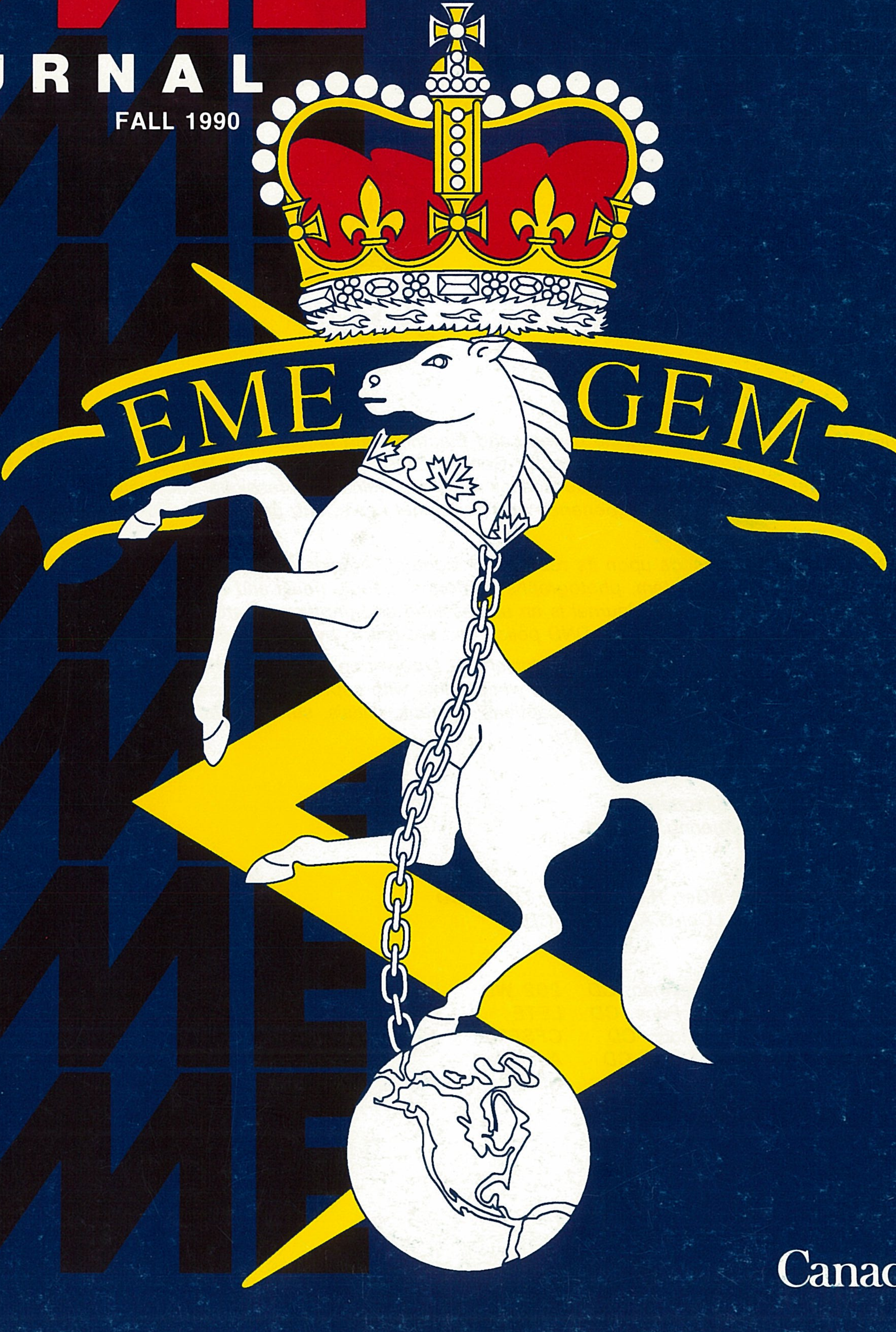

Canada

The EME Journal is the magazine of the Land Electrical and Mechanical Engineers, published at NDHQ under the terms of reference of the Director General Land Engineering and Maintenance and the LEME Branch Adviser. The purpose of the publication is to disseminate professional information among members and exchange opinions, ideas, experience and personnel news, and promote the identity of the LEME Branch.

The EME Journal depends upon its readers for content. Articles on all aspects of the Electrical and Mechanical Engineering System, photographs, cartoons, people news and comments are solicited. Readers are reminded that the Journal is an unclassified and unofficial source of information. The contents do not necessarily represent official DND policy and are not to be quoted as authority for action.

Contributors are asked to submit the original text typewritten, double spaced, paper size as herein. Photos should be sharp, glossy, black and white prints with captions typed separately. Personnel should be identified in all cases, both text and captions, by rank, initials, surname, trade and unit.

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From the Director General Land Engineering and Maintenance and LEME Branch Adviser

by BGen R.N. Fischer

Many of you will be aware that I officially took up my appointment as DGLEM and LEME Branch Adviser on 15 November 1990. As I begin to assume my responsibilities, I am mindful of my predecessors and the enormous contributions they have made throughout the evolution of our Branch. On behalf of the Colonel Commandant, and all members of the LEME Branch, I would like to thank BGen Jim Hanson for his stewardship during the past three years and especially for having successfully pursued the approval of our new badge. We wish him every success as he takes up his new appointment as Director General Military Review at NDHQ.

While none of us can predict the future, recent international events and technological developments suggest that we are entering an era where coping with change will become our major challenge. This situation will likely be compounded by economic instability and uncertainty. Already, we are seeing evidence within the Department of significant initiatives aimed at responding to this changing environment. This will unquestionably lead to a need for changes within the Land Maintenance system. We will succeed in meeting these challenges if we draw on the traditional strengths and values of the LEME Branch and take full advantage of the opportunities which invariably accompany change. Amidst all of this turbulence, the Craftsman must remain our most important resource. The nineties will test our collective leadership and managerial skills; ultimately it is the professionalism of all members of the Branch which will carry us through this decade with flying colours.

The LEME Reserve is also an important part of our future. The forthcoming restructuring of the CF under the Total Force concept should have a considerable impact on the LEME Branch. The training of our Reserves presents a major challenge to LEME and indeed the CF. We are actively pursuing the requirement to produce an effective and efficient Total Force of LEME tradespersons and officers and I personally would be interested in any ideas you may have on how we best can achieve this goal.

I also want to hear from the many civilian employees across the Land maintenance System, after all you are members of the extended LEME family.

By now you should be all aware of our plans to celebrate the 50th Anniversary of RCEME. One of our major objectives is to raise funds for a monument to commemorate this major milestone in our history. I strongly encourage you to participate in the national fund raising activities and to develop your own schemes to raise funds. Start planning your local activities now, 1994 is just around the corner!

A few words about the EME Journal. Over the years this publication has undergone several name, format and content changes. It has now reached the stage of being regarded as one of the more professional engineering journals in the Canadian Forces. In my opinion it has the right mix of technical and Branch related articles; there should be something in it to interest all members of the Branch, so please ensure you give it the widest distribution possible. Its your Journal, I strongly encourage you to communicate innovative technical solutions, to announce the recipient of a special award or simply use it to inform the rest of us about your activities. A lot of work goes into the publication of an issue of the EME Journal; let the Editor know what you like or don't like about it. He values and appreciates your comments.

As I develop and begin to articulate a vision of the way ahead, I will be seeking your views and concerns. The Colonel Commandant, Branch Chief Warrant Officer and myself will make every effort to get around and visit as many of you as possible in the course of the next year.

Arte et Marte

Letter to the Editor

I believe it is time to bring up the subject of UCRs submitted by our EME personnel.

There seems to be this great misconception amongst our junior tradesmen and unfortunately some of our senior citizens, that the more UCRs you submit the better it is for one's career progression.

Along the same line there is also this lingering belief that to be recognized you must stand out regardless of the means. I must recognize that if you properly identify a problem, bring it up through the proper channels after having had a thorough evaluation, sure, people will recognize your efforts, your concerns, your dedication. On the other hand, if you simply "pass on" a problem without first evaluating the real cause ie: isolated case, then the other extreme can and should happen; your name will be in the limelight as you so wished, but to your detriment. You have likely wasted a lot of valuable maintenance time which could be spent on real problems.

If one wishes to ventilate his frustrations about shoddy workmanship, he is encouraged to use TFRs which covers most EME problems and get quicker attention.

I am not discouraging Technicians to submit UCRs, I am simply bringing out a problem that could easily be solved at lower levels.

My frustrations have been ventilated in writing this letter.

MWO McNicoll J.A.L.
411 Veh Tech Base Maint (L) Lahr

Dear Master Warrant Officer McNicoll

There are two separate issues in this letter that I would like to address. These are the "misconception" and the suggested use of the TFR.

The "misconception" is not really as great as it may appear on the surface! Proper preparation of the UCR, complete with analysis and investigation is demanding work. Staffing of a UCR is consecutive, which is both its strength and its weakness. Each step in the staff chain must review and comment on findings-to-date and the frivolous should therefore be eliminated early. The process, however, is time consuming. The "notice me" guy should be identified and weeded out at the first review, usually by the section head. There is some truth that the more legitimate and substantiated UCRs you submit the more you will be noticed, and yes, the better it is for your career. Remember the adage, the harder a man works the luckier he gets.

And by the way, that "isolated case" may be just the first occurrence of a trend that has yet to be identified.

The TFR was originally intended to provide LCMMs with advanced notice of equipment failure during the introductory phase. Its use has since been expanded somewhat, but it is still restricted to technical failures of specific equipments only. Shoddy workmanship alone is clearly an unsatisfactory condition, which in accordance with current regulations, demands an Unsatisfactory Condition Report. If that "shoddy workmanship" resulted in technical failure of a CFTO specified equipment then it would indeed warrant raising a TFR.

While I can agree with the main thrust of this letter, the value of the UCR and TFR cannot be over stated. We have the best fault reporting system in NATO and for it to remain so it must be supported. Elimination of the superficial UCRs (those raised merely as a career advancement ploy), is a leadership responsibility. Just as flippant reporting must be discouraged, leadership is needed to identify and report those very real technical failures and unsatisfactory conditions that do exist.

CR Tramer
Major
DLES 2-2

Land Electrical and Mechanical Engineering Association (LEMEA) Report

Objectives of the LEMEA

You may think that the LEMEA is just an old boys' club and not for you. Not so! Read on. Its much more than that. The Association is of interest to all members of the LEME Branch whether they be Regular Force, Militia or Retired. For example, its objectives include;

— helping the LEME Militia,

— representing the interests of the LEME Branch to the Conference of Defence Associations and through it proffering professional advice to the Government of Canada on defence and security matters,

— encouraging cooperation with other branches,

— facilitate and maintain liaison and cooperation between the LEME Militia units and the LEME Regular Force units, and

— camaraderie.

Resolutions at the 1989 LEMEA AGM

Such resolutions deal with a variety of issues of concern to the LEME Regular Force, the LEME Militia and to Canada as a whole. As promised in the last report, here is a digest of the eight Resolutions approved at the 1989 LEMEA AGM.

Six resolutions were forwarded to the Conference of Defence Associations and were approved there in January 1990 at the Conference's Annual General meeting and recommended that the Minister of National Defence;

— develop and conduct, in cooperation with provincial authorities, an apprenticeship program to train GMT qualified Militia personnel to the civilian journeyman level,

— communicate to the Government of Canada the need to provide employers with financial incentives to make available employees for up to two weeks for military training over and above the employees vacation entitlement,

— impress on the Government of Canada the need to accelerate and reinforce reserve force publicity in order to ensure the objective of a viable reserve force is achieved,

— put in place a long-term defence plan for Canada and thereby allow the Conference of Defence Associations to properly fulfil their functions,

— ensure the continuation of the Speakers' Bureau and provides sufficient information about the availability of speakers for this purpose and

— impress on the Government of Canada the need to reinstate the funding of such fleets, as the NTV and the LSVW to the pre-April 1989 level and schedule so that the Defence of Canada requirements established for such fleets are not adversely effected and that technical and industrial experience developed in the past decades are not allowed to decline.

The two resolutions forwarded to FMC recommended that the Commander;

— restructure qualification training so as to implement home study packages for all knowledge requirements which may be reasonably acquired through such methods.

— expedite the publishing of a revised PRS for the previously identified equipment.

Affiliations With Other Associations

At the LEMEA 1989 AGM last October there was a discussion on what other associations that the LEMEA could be usefully be affiliated with. It was suggested that the LEMEA should break its affiliation with the Canadian Institute of Strategic Studies because the interests of the two no longer sufficiently overlapped. The CISS currently focusses on the international geo-political/military level whereas the interests of the LEME Association are more domestically oriented and include defence-industrial preparedness.

Consequently, it was suggested that the LEMEA establish contacts with two other Associations, the Friends of the Canadian War Museum and the Canadian Defence Preparedness Association. These suggestions have been actioned. Here is a brief overview of these two organizations and what the LEMEA hopes to achieve by being affiliated with them.

The *Canadian Defence Preparedness Association (CDPA)* brings together individuals and corporations who are dedicated to scientific, engineering, industrial and management preparedness for the common defence as one of the strongest guarantees of national security and peace.

The CDPA operates as a patriotic, educational, non-political and non-profit making membership society. It draws revenues from membership fees and from the conduct of seminars, conferences and business luncheons. It publishes and distributes a bi-monthly newsletter describing meetings, shows, demonstrations etc. of interest to the defence industry community. It also distributes papers and newsletters published by the American Defense Preparedness Association with which it has a close association.

The members of the executive are all volunteers who devote their time and frequently some of their company resources to ensuring that the objectives of the CDPA are met.

The LEMEA, as a member of CDPA, has one of its members participate in CDPA functions, receive CDPA-distributed literature and ensure dissemination of CDPA information to the LEMEA membership.

The secretary of the CDPA, MGen (Retd) E Creber who is a former DGLEM and member of LEMEA, notes that such affiliations with the CDPA are encourged because they help disseminate information regarding Canadian defence-industrial preparedness — a major interest of all members (Regular Force, Militia or the Association) of the LEME Branch!

The ***Friends of the Canadian War Museum*** (the Friends) assist the Canadian War Museum (CWM) in preserving Canada's military heritage by providing voluntary help to the CWM in maintaining its collections and lobbying to help improve its accommodation. Affiliation with the Friends enhances the LEME Branch's association with the Base Borden Museum.

Many of the Friends as individual volunteers help in the care of the collection. For example one Friend, who is an expert on and has a large collection of swords, has over the past couple of years expended many hours of his own time at no charge in refurbishing the Museum's sword collection.

It is of interest to note that three of the CWM's Canadian-made World War Two vehicles are being refurbished with the help of LEME. Two, both armoured cars, are being done at the Proving Grounds in Orleans for display outside the CWM. The third, a 5-ton workshop van, is to be done at the School and will be available there during the 50th Anniversary of RCEME celebrations in 1994.

Watch for the next report which will include an overview on the organization of the LEMEA and some of its current activities.

441 Mat Tech Update

by LCol R.A. McLeod

Introduction

The Materials Technician Occupation became five years old in Jan 90. It entered its sixth year a flourishing occupation still with some growing pains but with a bright future and a solid reputation for high quality versatile technicians. We can look forward to more stability than before, but as the Army learns more and more the capabilities of the Mat Tech the more we will change to match the requirement.

Occupation Advisor

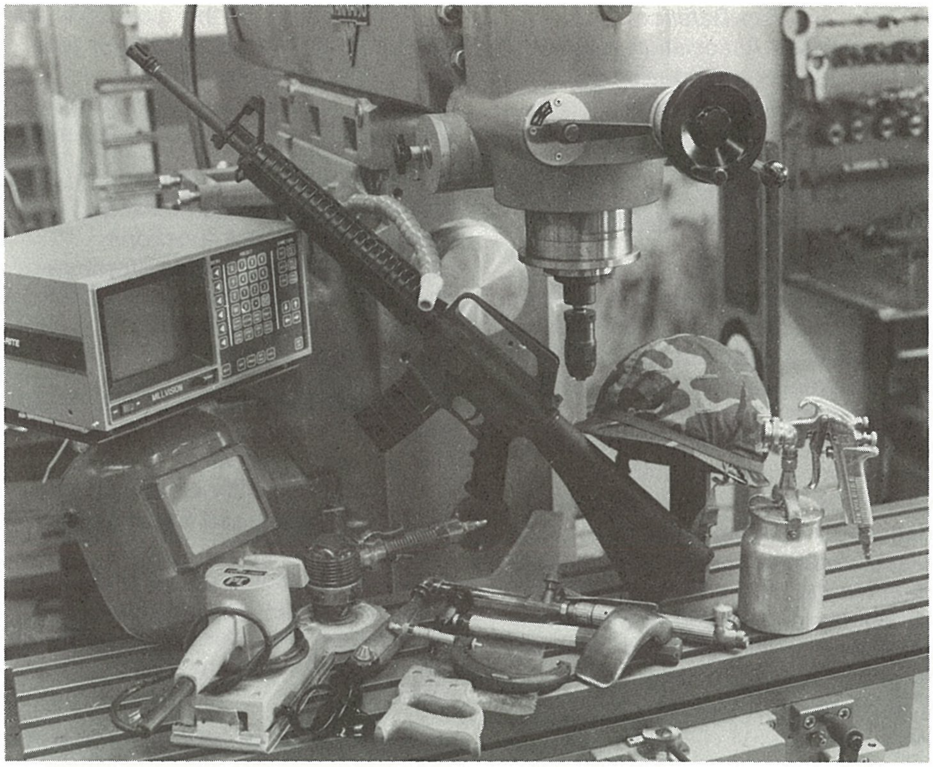
The continuity in the Occupation Advisor's office was capably provided for by MWO Paul Slominski as we saw a change of Advisors from LCol Beselt to LCol McLeod. Although he held the position for only one year LCol Beselt's staunch support for Materials Technicians was evident and endures in many areas; including the LENCO welding trainers at CFSEME, and a welding engineering contract which will produce welding data sheets and standards to aid our work. LCol Beselt moved to command 1 Svc Bn but his contributions to the Mat Tech Occupation are appreciated.

Establishment/Manning

The occupation is now to the point where manning is approaching the authorized strength and strong recruiting should help continue this improvement. The status as at 15 May 90 is:

Rank	Establishment	Effective Strength
CWO	3	3
MWO	5	5
WO	14	15
SGT	47	38
MCPL	54	44
CPL	94	147
C/P	91	22
TOTAL	307	308*

* This figure includes 33 in the training system. There are 275 personnel trained QL 3 or better.



After no promotion to CWO in 1989 we received two in 1990, CWO Dennis Henry and CWO Jeff Chaloner, and the prospects for regular promotion opportunities look good. The full 1990 promotion forecast is:

Promotion to Rank	1990 Forecast
CWO	2
MWO	0
WO	1
SGT	13
MCPL	18

Training/Occupational Specifications

After an initial delay in staffing the results of the Dec 88 Course Training Standards Review things are moving again. The CTP and training that follow will reflect the amended Occupational Specification including: more composite materials, introduction of maintenance on the new C4 mask; the move of some machining training from the 441.01 (adv machining) to the QL 5A and minor adjustments in other areas including autobody. As for the Occupational Specification itself, it has been adjusted over our first five years to reflect the changing needs, but a full formal analysis is needed and an Occupational Analysis for the Materials Technician has been requested for 1992.

Our Mat Tech training facilities continue to be taxed to the limit and night training is conducted in Mat Platoon at CFSEME in an effort to cope with the load. The 411.10 Autobody for Vehicle Technicians has been cancelled. An additional five badly needed instructors were recommended by the 1989 OSER and could provide some relief in 1990. A new Mat Tech welding facility is the CFSEME number one construction priority. The LENCO Welding Trainers are being well utilized and stands are being made for training on overhead welding. The training load for 1990 is:

	Courses	
QL 3	4	(10 students)
QL 5A	3	(10 students)
QL 6A	1	(10 students)
OSQ 441.01 (Machining)	1	(5 students)
OSQ 441.02 (Adv Welding)	1	(5 students)

Validation of the requirement for a Sewing Machine Maintenance Course is ongoing and it is hoped that training at CFSEME based on the CFSATE Course can be conducted by 1991.

Working Group

A Mat Tech Working Group Meeting was held at LETE 23-24 Jan 90. It got together 28 Mat Techs from throughout Canada and CFE and senior Command and NDHQ staffs to exchange information and collectively provide input to the direction in which the occupation is headed. Some major areas identified as requiring attention included:

a. *Occupation Specifications* — It was determined that other occupations have unrealistic expectations of what the occupation is capable of and that the occupation specifications should be more widely distributed.

b. *Concentrate on Basic Skills* — It was felt that we were losing sight of what basic skills were needed and that we could branch out too far, and lose sight of what our occupation is supposed to do. At the same time it is important that everyone remain aware of new materials and technologies which could impact on our occupation.

c. *Job Rotation* — It is essential that all OQ3's, 4's, and 5's be rotated throughout the trade and it is especially so for the OQ3's and 4's. It was recommended that more coordination/cooperation be estb between 1st and 2nd line units. It was also important to remember that individuals progress at different rates.

d. *Training* — OQ5 trg should be broadened to include composites, machine lathe, APC MILLAV and AVGP. OSQ 02 should include bridging, TOW under armour and Lepoard. A third OSQ should be initiated which will cover all aspects of composite materials.

e. *Rotation* — The senior unit rep must be responsible for ensuring that the OQ4 gets the proper trg. He must make sure that the tech gets rotated through all aspects of the trade and that he is ready to go on his OQ5 crse. The Occupation should also be allowed to rotate through the various branch duties such as control office posns and also be included in branch appointments; CSM's, RSM's etc.

f. *LCMM* — Jigs, fixtures, and speciality tooling, should be an automatic issue. The LCMM must also include trg manuals and repair manuals which cover general and specific repairs. Specific repairs should be written so that all information as to equipment settings and method of repair is included. Each new piece of equipment should be accompanied with a manufacturer run course as is currently being done for some of the items.

g. *Health and Safety* — CO's and OC's at all levels should use the expertise and experience of the specialist (Mat Tech) when it comes to occupation related functions. Paints are a prime example. They are used by almost everyone in every unit, either at home or in the work place. There is very little education being undertaken to instruct everyone in the safe application of paints.

h. *ATI's* — It was felt that the occupation must take an active part in ATI's. At the present this is not happening in most units. There is a need to identify what is required to be inspected and in addition it is advisable that the tech be involved at an early stage of his career so that he will have an understanding of the requirements when he gets to a senior position and may have to schedule one.

Medium Floating Bridge (MFB) Repair

A very successful two week course was conducted in Apr 90 at EWK, Kaiserslautern, FRG to teach Canadian Forces Mat Techs the repair to third level of the new MFB. The techs got to do actual repairs on bridge sections and participate in the preparation of a training film to be used at CFSEME and to supplement CFTOs at the bases.

The Future

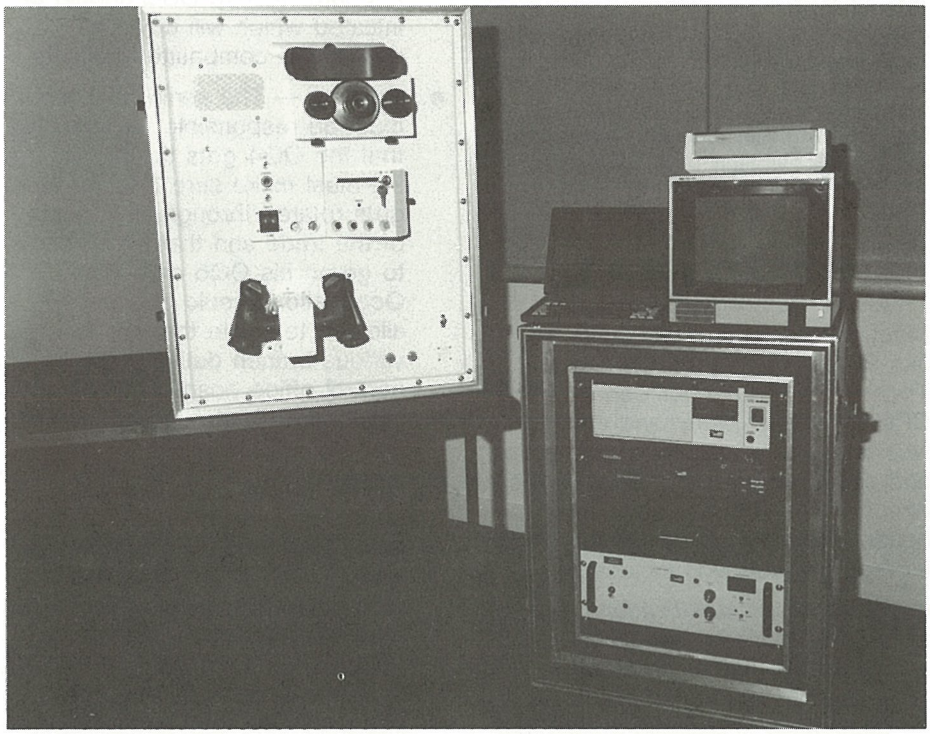
As the reputation and the versatility of the Mat Tech has increased, so has the complexity of his work and the materials he uses and repairs. Our OA planned in 1992 will look at these things, among many others, including the time we must spend training for the widely varied responsibilities. In the meantime, we now have a Materials Engineering Services Contract with a civilian firm to provide engineering expertise in developing repair procedures. The MILLAV Project will provide the correct training aids and welding equipment for hull repairs to the new Bison Wheeled Armoured Vehicles. The C4 Mask Project will add approximately 20 Mat Tech positions to our establishments and ECPs should establish WO positions in Calgary and Petawawa. Our recruiting (two LOTRP and four recruit OQ3 courses in 1990) is exceeding attrition. Mat Techs have built a solid reputation. Now that the manning shortages are being relieved Mat Techs can soon fill their share of the workshop and headquarters' positions to get the rounded experience we expect of all EME technicians.

FROM DGLEM DIRECTORATES

DLAEEM

Progress in Simulators and Trainers – VIGS Technology

by Capt D.O. Schroeder



Requirement

The land Forces have a requirement for gunnery simulators to train tank and infantry gunners in all aspects of gunnery. Current gunnery training methods are varied and involve the use of classroom instruction, indoor miniature ranges, outdoor dry firing procedures training, safety training and range firing. These training techniques are not always totally effective.

The Land Forces training strategy now emphasizes the maximum use of simulation systems in training. Some factors that also encourage the use of simulation systems include the high cost of live rounds; the concern for safety; the availability of and environmental damage to ranges; a lack of an objective means for assessing gunner performance; no immediate feedback on other aspects of the engagement; and the avoidance of wear and tear on vehicles and costly components.

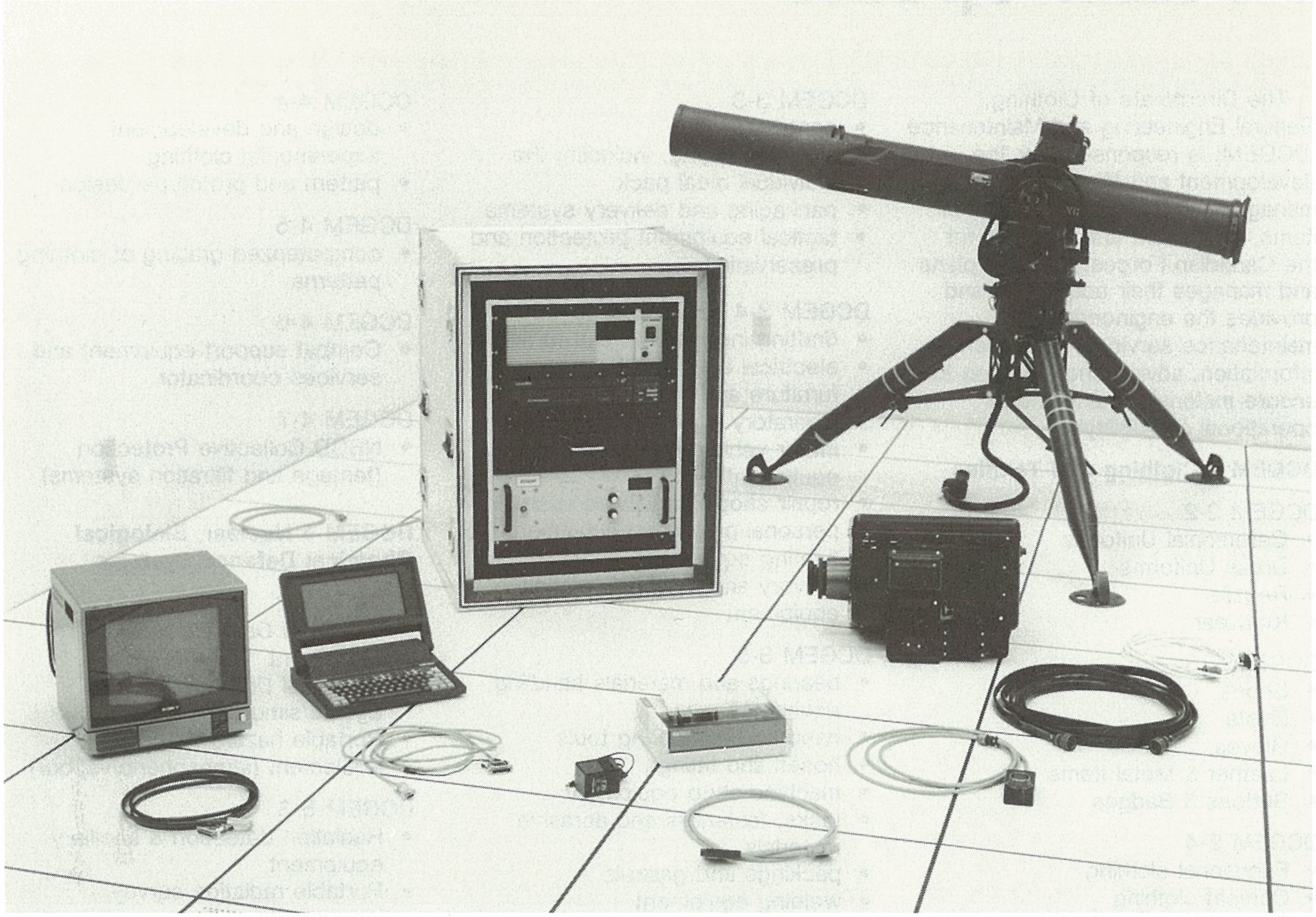
Background

In the early 1980's the Defence and Civil Institute of Environmental Medicine (DCIEM) bought a commercial tank gunnery system and a study was undertaken to determine if a part task trainer could be used to effectively teach tank gunners proper gunner techniques. Initial trials were performed and the results were encouraging. The original trainer was modified to resemble a Leopard C1 gunner's position and further testing revealed the part task trainer was an effective training device. The main deficiency of the commercial trainer was the poor visual system. DCIEM investigated the problem and produced an experimental development model (XDM) of a generic visual system. This system proved to be superior to other systems on the market.

The plan is to use the XDM visual system as the core of a generic unit called the Video Interactive Gunnery Simulator (VIGS) for use with the TOW 2, Leopard and Cougar simulators. In 1987, PMO AALAV funded a contract for three advanced development model (ADM) TOW Video Interactive Gunnery Simulator (TVIGS) and DRDL funded development of two ADM Leopard Video Interactive Gunnery Simulators (LVIGS). Bendix-Avelex won the TVIGS contract bid in November 1987 and in July 1988 was awarded a sole-source development contract for the LVIGS.

Visual System

The XDM visual system, which makes use of the latest video technology to improve the quality of the video imagery, is the 'heart' of the VIGS. This system enables video signals to be transformed in a number of ways, thereby, permitting these signals to be used as visual imagery for interactive training simulators. The video image from the video source (the videodisc player in the VIGS case) is digitized in analog to digital converters. The output from analog to digital converters is sorted in, and retrieved from, high speed serial access memory devices in such a way as to make it appear the image is zoomed and permit pan and scroll of the video image in real time (i.e. at rates equal to 30 frames per second). A joystick, or other



displacement type input device, coupled to a microprocessor may be used to select image content. In addition, imagery generated by computer software may be written into display memory thereby allowing this imagery to be superimposed upon the video background. In this way, special video effects may be created. The output of the system is fed to digital to analog devices which permit the signals to be displayed on a commercial monitor.

LVIGS & TVIGS

The LVIGS and TVIGS are stand-alone simulators intended to allow low-cost, part task training of important gunnery skills. Both systems, which have a 60-70% commonality of hardware and software, permit interactive training with video recordings stored on a videodisc. The training scenes consist of prerecorded scenes which show various types of targets, either static or moving, on different types of terrain. These are observed through the sight assembly with the targets being engaged by manipulating the power controls on the LVIGS or by changing the line-of-sight on the TVIGS. A graticule pattern is seen within a circular field-of-view, and when the trainer is fired, visual effects such as smoke and fall-of-shot are indicated by an overlay of low cost, computer generated imagery. Sound effects are also provided. Specific visibility conditions, such as fog or thermal scenes, may also be simulated. The instructor station permits continuous monitoring of student performance and the capability to record student engagements for analysis and debriefs.

Conclusion

VIGS is a generic trainer which uses state-of-the-art technology and provides realistic training and performance assessment at low cost. The VIGS system is suitable for a large number of military training situations, especially those involving direct fire weapons.

Presently, trials are being conducted on the two pre-production LVIGS at CTC, Gagetown. Trials are also being conducted on the TVIGS at CTC, CFE and LETE. The CVIGS development should commence in the Fall of 1990.

DCGEM

DCGEM Update

The Directorate of Clothing, General Engineering and Maintenance (DCGEM) is responsible for the development and life cycle management of a diverse range of items, equipment and systems for the Canadian Forces. DCGEM plans and manages their acquisition and provides the engineering and maintenance services, technical information, advice and direction to ensure material readiness and operational availability:

DCGEM 2 Clothing and Textiles

DCGEM 2-2
- Ceremonial Uniforms
- Dress Uniforms
- Regalia
- Knitwear

DCGEM 2-3
- Shoes
- Boots
- Gloves
- Leather & Metal Items
- Buttons & Badges

DCGEM 2-4
- Functional clothing
- Combat clothing
- Special Purpose Clothing

DCGEM 2-5
- Textiles
- Ropes
- Flags & Pennants
- Table & Bed linen
- Rank Braid

DCGEM 2-6 & DCGEM 2-8
Special projects on
- Combat helmet
- Fragmentation protection wear
- NBC suit

DCGEM 3 General Engineering, Material, Tools and Equipment

DCGEM 3-2
- chemicals
- coatings
- petroleum, oil and lubricants
- plastics
- rubber

DCGEM 3-3
- containers
- food packaging, including the individual meal pack
- packaging and delivery systems
- tactical equipment protection and preservation

DCGEM 3-4
- drafting instruments and furniture
- electrical equipment
- furniture and appliances
- laboratory equipment
- motor vehicle maintenance equipment
- repair shop specialized equipment
- personal protective equipment/fire fighting equipment
- servery and food preparation equipment

DCGEM 3-5
- bearings and materials handling equipment
- hand and measuring tools
- hoses and fittings
- machine shop equipment
- locks, fasteners and abrasive materials
- packings and gaskets
- welding equipment
- workshop equipment and metals

DCGEM 3-6
- non-electrical lighting fixtures
- signs and identification plates
- small arms target supplies
- sporting and recreational equipment

DCGEM 4 Combat Support Equipment and Services

DCGEM 4-2
- tentage and field shelters
- camouflage and concealment
- vehicle tarpaulins
- equipment covers

DCGEM 4-3
- personal combat support equipment
- life preservers and jackets
- NBCD carriers and auxiliary equipment
- non-powered oversnow equipment

DCGEM 4-4
- design and development experimental clothing
- pattern and prototype design

DCGEM 4-5
- computerized grading of clothing patterns

DCGEM 4-6
- Combat support equipment and services coordinator

DCGEM 4-7
- NBCD Collective Protection (tentage and filtration systems)

DCGEM 5 Nuclear, Biological Chemical Defence Systems

DCGEM 5-2
- Chemical Defence training equipment
- Chemical Defence training agents/simulants
- Portable hazard detection equipment (atmospheric/vapour)

DCGEM 5-3
- Radiation detection & ancillary equipment
- Portable radiation survey instruments
- Installed radiation detectors
- Individual/Tactical dosimetry systems
- Calibrators

DCGEM 5-4
- Ionizing radiation safety authority
- Licencing of radioactive material
- Compliance inspections
- Disposal of radioactive material

DCGEM 5-5
- Gas masks
- Canisters
- Ancillary equipment

DCGEM 5-6
- Chemical (wet chemistry)
  Detection equipment
  Detector kits
  Vapour/liquid detectors
- Decontamination equipment decontaminants
- Internal security equipment/agents

DCGEM 5-8
- Chemical/Biological detection & alarm equipment
- Chemical agent monitor equipment
- Chemical agent alarm and equipment
- Ancillary test equipment

DCGEM 6 Administration, Trials and International Programs Corporation

DCGEM 6-2
Trials and International Programs
- Military engineering and user tests and trials of equipment and clothing
- International technical programs involvement and special projects
- Conference and display facilities
- Sealing of patterns
- Office furniture and equipment

DCGEM 6-3
Administration
- Publications and records management
- Budgetary planning
- Analysis of training needs and development of training program
- Management information system
- Personnel and staff relations
- Human resource planning

DCGEM contributes to the operational effectiveness of essentially all equipment used by the Canadian Forces.

The NATO Single Fuel Concept

(By Capt M.P. Turingia)

What is the NATO Single Fuel Concept (SFC)? Simply stated the SFC is the use of one common fuel by *all* aircraft and land systems within NATO Europe.

The change to a single fuel will bring about a fundamental change in an army combat supply. The ramifications of this change on our current battlefield practices are now being assessed.

The question of which fuel is best suited to fuel all jet fighters, transport aircraft, helicopters, tanks, wheeled vehicles, and generators, is answered by JP-8, otherwise known as NATO Code F-34. This is a commercial jet fuel (Jet A-1, NATO Code F-35) to which a corrosion/lubricity improver, and a fuel system icing inhibitor have been added. This aviation turbine fuel was selected because compression ignition (diesel) engines can operate with it and because of its commercial availability. As the kerosene blend of F-34 makes it similar to an arctic diesel fuel specification, it is well suited to cold environments. Regular diesel fuel (NATO Code F-54) does not function without cold weather modifications at temperatures below

Members of the NATO Ground Fuels Working Party relax after their 13th meeting, heald 18-21 Oct 88 in Rome, Italy Front row, 2nd from right – Canadian delegate, Capt M.P. Turingia, DCGEM 3-2-2

−18°C, whereas F-34 remains functional even when the temperature drops to −47°C.

Throughout military and civilian sectors, the demand for gasoline has been steadily diminishing over the years. To eliminate this fuel dependency, NATO nations have agreed in principle to buy only compression ignition/turbine powered vehicles and equipments. This will gradually eliminate the gasoline requirement from forward areas as the gasoline fuelled vehicles and equipments are replaced with F-34 capable fleets. The withdrawal of bulk gasoline from the Central European Pipeline System has currently been forecasted to occur by the year 2000. Consequently, fleet planning decisions can be expected in the future for the Iltis and 5/4 Ton fleets in Europe.

Supplementing the obvious tactical advantage of using only one fuel on the battlefield, there is a financial incentive to adopting this concept. A current US study has estimated that for its European forces the SEC will cut costs by 10% while simplifying fuel handling.

With all the inherent advantages, what could the possible deficiencies be? Current technical problems which have been identified with land force implementation of the SFC are:

a. accelerated wear for some rotary fuel pumps and injectors with the less dense F-34 fuel;
b. top end power losses in some engine designs;
c. increased volumetric consumption rates with the use of F-34, resulting in a reduction of vehicle range and an increase in fuel transport;
d. diminished smoke production in smoke generators; and
e. reduced engine performance and cold weather startability with low centane F-34.

Although all NATO aircraft (except for one in Turkey) are now capable of using F-34, NATO land forces are only now addressing its technical viability in vehicles and equipments. With the diversity of current vehicle and equipment fleets, consultation and coordination is necessary with the many operational and logistical staffs of DND, as well as those of NATO nations

The Ground Fuels Working Party (GFWP) of AC/112 (WG/4) was formed to address these technical problems. This forum comprises the technical POL specialists of all NATO nations. Consequently, a comprehensive series of trials have been initiated by nations to establish the technical viability of F-34 in national land vehicles and equipments. The results of completed test programs are shared with all member nations.

Although DND has not yet commenced its test program on Canadian vehicles and equipments, the program should be in place in early 1990. The Canadian program will not duplicate the tests performed by other nations on similar equipment, but will supplement the technical investigations already conducted. For example, the US has shown in laboratory bench tests and at the Fort Bliss (3000 vehicle trial) base trial that APCs are capable of continuous F-34 operation in hot ambient conditions The Canadian test program might then establish cold weather comparisons of F-34 with diesel fuel, with an emphasis on operational performance, and engine reliability and maintainability. Canadian specific equipment would also be subjected to these comparison tests.

The SFC has, in part, become an interim solution to the deteriorating quality of available crude oils, and the production of less stable fuels. One cannot help but wonder what avenues will be investigated 20 years from now to satisfy the military fuel requirement. Undoubtedly, DCGEM will again be called upon to provide technical guidance to the Canadian Forces.

Electronic heat Sealing of PVC Material

CWO Henry DCGEM 3-5-2

Polyvinyl chloride (PVC) sheet materials are presently being used to manufacture a wide variety of items used by the CF. These range from doors, windows and tarpaulins on the ILTIS and MLVW vehicles, tarpaulins for the Leopard tank, helicopter maintenance shelters and many others. Because of the characteristics of PVCs, such as light weight, durability, resistance to water and ability to stand up to extreme temperature conditions, the use of these materials is expected to increase in the future.

PVC repair kits for use at 1st and 2nd line repairs are available to the CF but are only intended for small holes or repairs. DCMEM 3-5 was tasked to find suitable equipment for larger repairs to satisfy what could be seen as a growing need. A quick search of the tent and awning industry revealed that suitable equipment was available on the market. A purchase description was written and the most suitable machine was chosen from the bids which were submitted. Ten machines were purchased from CALLANAN CO of Chicago who have manufactured this type of equipment since 1949.

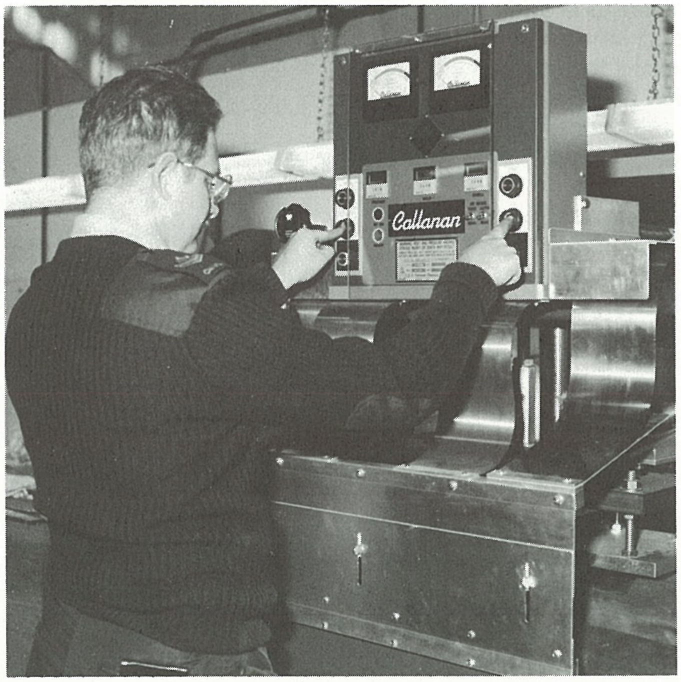
In order to weld PVC materials the principle of an electric power usage known as dielectric hysteresis is used. This involves subjecting the PVC sheeting to an electrostatic field, the polarity of which is alternated millions of times per second. The distortion and re-orientation of the fabrics molecular elements results in more or less friction which causes melting and the consequent uniform bonding together of those areas subjected to the electrostatic field. The materials are clamped between two-dies during the application of the electric power. The principle factors are, power, time and pressure.

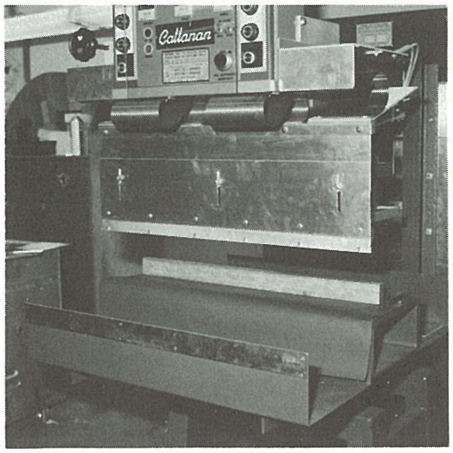
Ten bases have been selected as holders of these machines. They are: CFB Chilliwack, CFB Calgary, CFB Winnipeg, CFB Petawawa, CFB Toronto, CFB Valcartier, CFB Gagetown, CFB Lahr, CFB Borden, and 202 Workshop Depot, Montreal. Some of these bases will be identified as strategic repair points. The Operation of these machines falls within the responsibility of the Mat Tech trade (MOC 441). As each machine was sited and power connected the supplier was responsible for giving a training session which covered the basic theory of PVC heat sealing and also some hands on application.

Machines used for electronic sealing are simple to operate and once the initial bugs have been removed and a level of expertise developed, they can be expected to give many years of trouble-free service. They are composed of three basic units:

a. a generator or frequency converter to change the commercial low frequency power supply to high frequency electrical energy;
b. a pneumatically operated press to raise and lower the die and to supply the necessary pressure during the welding cycle;
c. a die of the required outline and dimensions to seal the desired shape and area of the film or sheet.

The process of sealing or welding is accomplished by placing one or more pieces of plastic sheet or film on the lower die plate, another or several pieces are then placed on top and the upper die is lowered and the necessary air pressure applied. The high frequency energy is applied at either a fixed or varying rate for the required cycle. The increasing rate of change in todays technology requires a diversification of skills and the ability to learn quickly. The acquisition of electronic heat sealing machines will add a new dimension to the Mat Tech trade. As experience is gained and knowledge accumulated the benefits will be obvious.





The C4 Mask —
A New NBC Mask for the Canadian Forces

by CWO H.P. Searle

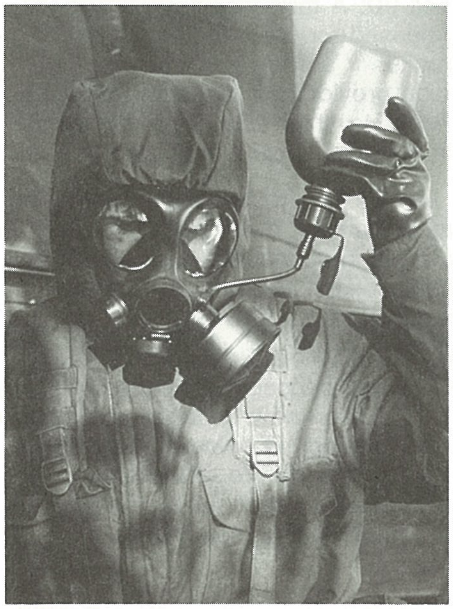
NBC training within the Canadian Forces has never been one of the favourite pastimes for CF personnel. One of the reasons is the restrictions associated with the current in-service C3 mask. Although the C3 mask has been extensively modified to provide better protection, due to its design, it cannot be further modified to provide the additional protection and features required of a modern respirator. The C4 mask has been designed with an increased shelf life, improved protection, enhanced vision, better communication provisions, left or right side canister mounts, a drinking facility and greater wearing comfort. It incorporates all of the design requirements stated in the draft Quadripartite Standardization Agreement (QSTAG 695) Standards for General Service Respirators/masks out to the year 2005.

The Canadian Forces have established that the more limited field of view of the current C3 mask degrades the wearers performance in many tasks requiring visual acuity. A maximized field of view was therefore a primary requirement, along with a capability for through-the-mask intake of water and liquid nourishment. Also stated was a requirement for improved protection using both new materials and designs and improved performance, especially in the area of electronic communications. Finally the Canadian Forces felt that their personnel may in the future be forced to wear their masks for prolonged periods of time and that comfort would be an extremely important factor.

Soldier firing rifle donned with C4 Mask and CW Ensemble

The facepiece is moulded from a synthetic rubber (bromobutyl rubber) and is resistant to the penetration of agents under all field situations. Agent resistant thermoplastics are used for the majority of the other components in the mask. The lenses are moulded of a polycarbonate material and specially coated for scratch resistance. These lenses provide a high level of impact resistance (i.e. the impact of a quarter inch steel ball at a velocit of one thousand feet per second will not shatter the lens) providing the wearer with considerable protection against flying objects such as shrapnel and secondary fragmentation. A secondary speech transmitter is mounted in the unused canister mount thus providing a dual speech transmitter. This feature improves the speech intelligibility and has made the mask compatible with telecommunications equipment. A drinking tube has been included which allows the wearer to intake liquids without unmasking. A bayonet connection, standardized by the US, Australia and Canada, is attached to the external end of the drinking tube and plugs into the special cap on the water bottle. When not in use, this bayonet connection is housed in a

Soldier wearing CW Ensemble and C4 Mask



Soldier using drinking facility on C4 Mask

special slot below the outlet valve to protect it from damage and contamination. Care was also taken in the design of the areas where the nosecup contacts the face, especially in the area around the bridge of the nose.

The nosecup is also made from silicone rubber for additional comfort and for its non-allergenic properties. However, the most important departure from traditional gas mask design is in the development of the headharness. Instead of using a pad on the back of the head attached to the mask by six straps, which can cause pressure points and a certain degree of discomfort, the headharness has been developed for the mask which evenly distributes the load over the back of the head. This allows the mask to be worn for long periods of time with little or no discomfort. A detailed anthropometric analysis was conducted of face shapes for both men and women in the Canadian Forces and a four size system was developed which will fit the 5th to the 95th percentile of this population. It is noteworthy that the C4 mask has been designed to have a ten year shelf life and a service life of seven years.

A mask is not complete without a canister and the C4 mask is supported by a family of canisters to meet a variety of needs.

The maintenance program now in place for the C3 mask is limited to backloading it to third line of 202 Workshop in Montreal.

This system is based on refurbishing the mask every four years and repairing masks when obviously damaged. This process has the potential of providing an 85 percent serviceability rate. The only way to ensure that complete serviceability may be attained in the minimum amount of time is to inspect and service at the levels below third line. To obtain this serviceability the Materials Technician Trade 441 has been assigned the responsibility to provide the necessary maintenance at first and second line. This approach is a radical change to the C3 mask maintenance procedures, however, the new maintenance schedule will ensure that a serviceable mask is available to the user at all times.

As mentioned above, the new C4 mask is state-of-art and a welcome piece of personal equipment for the Canadian Forces. Extensive trials with all elements of the Canadian Forces have been conducted and most everyone agrees that the improvements over the C3 mask will greatly improve the ability of the wearer to survive and fight in an NBC environment.

You might ask —

Will the C4 mask make it safer to cruise the NBC battlefield?
..... **YOU BET IT WILL!**

DCMEM

Marginal Terrain Vehicles LCMM Update

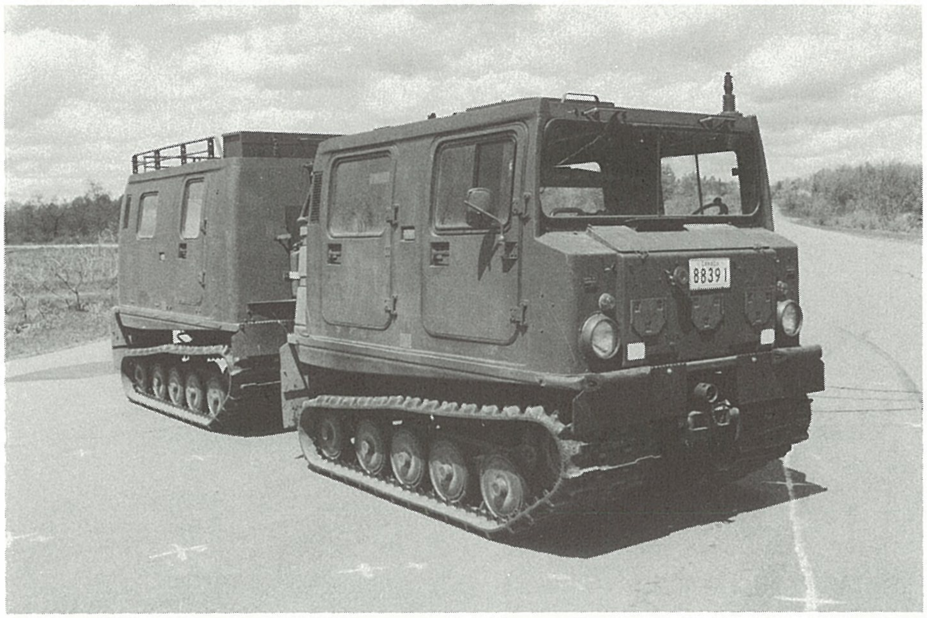
BV206 Fleet

The present fleet of BV206s has passed the first third of its forecasted 15 year lifespan. With the realignment of the CF European commitment, and the subsequent disbandment of the CAST Bde role in North Norway, the entire fleet of BV206s is now dedicated to AMF(L) operations. This has not affected the disposition of the 80 vehicles pre-positioned in Norway, however the Canada based vehicles, formerly held by units from 5 GBC, were redistributed to 1 PPCLI and 2 RCHA in the fall of 1989, to support AMF(L) unit training in Canada.

The present distribution of the BV206 fleet of 101 vehicles (81 pers/cargo, 12 CP, and 8 TOW) is as follows: 1 PPCLI – 16, 2 RCHA – 2, Norway – 80, Borden – 2, and LETE – 1.

Due to the low mileage and periodic use of the Norway based vehicles, and due to the movement of Canada based vehicles among CAST units, in the past it has been difficult from an LCMM's perspective to gain reliable data on maintenance trends. It is expected that now with the vehicles only being used for the most part by one unit, 1 PPCLI, more reliable and consistent data can be gathered which should make the job of the fleet manager easier.

Several people have recently revealed a problem over the terminology to be used when identifying the BV206 in-service fleet and clarification of the point should be made at this time. The present in-service fleet of BV206s was procured under the Medium OverSnow Vehicle (MOSV) Project. The Project was called MOSV to avoid confusion with the Northern Terrain Vehicle (NTV) Project which was, and still is, involved with a much larger procurement quantity. So perhaps we should only refer the present fleet as "MOSVs"; but that creates another problem because the TF20 airdroppable carriers held by the Airborne Regiment are also called MOSVs. Until the NTV Project BV206s are procured and handed over to the LCMM, it is requested that the in-service vehicle fleet be simply referred to as "BV206s", not "MOSVs" nor "NTVs". [It could also be added for a bit of trivia that the BV206 is categorized as a "medium" northern terrain vehicle (MNTV, or NTV for short) and in the future this fleet could be complemented with fleets of "light" northern terrain vehicles (LNTV) and "heavy" northern terrain vehicles (HNTV). But again, for the present, please only refer to NTVs in context with the NTV Project.]



BV206 LCMM Activities

Some of the major LCMM activities over the past year involved the development of several modifications. One of the more important involved the modification to the electrical junction box under the driver's seat. This mod was the result of a potential fire hazard which was determined to be the probable cause of a fire which had destroyed a vehicle at LETE. A second modification involved the development of an automatic engine shut-off system. This mod was developed to save engine loss due to overheating or loss of oil pressure and it should be ready for distribution to units by Fall 90. A third modification was released for the mounting of ski racks for artillery gun tractors. This mod provides for the stowage of L5 Pack Howitzer skis when deploying in marginal snow conditions.

In addition to the ongoing work on modifications, a number of studies are being sponsored by the LCMM. Descriptions of some of the main studies are as follows:

a. Road Wheel Bearing/Seal Study. Trials are being conducted at LETE on new bearings and seals. The study is being conducted to improve the life of existing bearings which fail prematurely in muddy/sandy conditions.

e. Diehl "125" Track Study. A study is being carried out at LETE on a set of Diehl track. The Diehl design is different from the existing "endless" rubber Skega track with it being constructed of four sections held together by dry pin connections.

f. Arctic Track Study. A study is being carried out to determine suitable designs for the manufacture of a track with the required flexibility and durability for use in extreme cold weather conditions. The present track becomes progressively stiffer in cold temperatures with a commensurate unacceptable decrease in vehicle performance.

g. Airdroppable Study. It is anticipated that the final phase of this $950k project for the development of an airdroppable BV206 will be successfully completed by Jan 91.

A recent project sponsored by the LCMM involved fibreglass body repair. The first airdroppable prototype vehicle, which received body damage during LAPES trials 1988, was given to 202 Workshop to determine the feasibility/capability of that facility to complete intricate BV206 fibreglass body repairs. The project was very successful with 202 Workshop technicians doing an excellent job with the vehicle.

During RV89 we had the unfortunate incident of having a second BV206 destroyed by fire. The source of the fire was located to the engine compartment but due to the extensive damage no exact cause could be determined. LETE has been tasked to investigate the installation of a fire suppression system and action is being carried out, through DPSL, for the replacement of the burned vehicle in this fiscal year.

The first BV206 Newsletter was published in Dec 89 and it is hoped that all those involved with the BV206 have had a chance to read it. A second issue is planned for Fall 90.

One of the more enjoyable functions for the LCMM is to visit the user units. It is easy to sit behind a desk in an air conditioned office in Hull and say over the phone to the Unit Maint O that he doesn't have a problem. It is quite a different matter when you are out in the middle of a training area, thirty-six hours into an exercise, in the mud and the rain, and the machinery won't do what you said it would. Although we didn't get the mud and the rain, we did get inside several Bde HQ and unit offices in CFB Calgary a couple of times over the past year plus we had a quick half-day with 2 RCHA and 2 Svc Bn Maint Coy in Petawawa. Additionally, an LCMM representative visited CFSEME on two occasions over the past year to work with Veh Coy staff on OSQ VB206 courses. All visits proved to be extremely rewarding, primarily due the healthy exchange of information and quick resolution of problems, only brought about by that essential face-to-face contact.

Commercial Marginal Terrain Vehicle Update

As LCMM of commercial marginal terrain vehicles, there is always a wide variety of projects and activities on the go. With over 20 different vehicle configuration to manage (from Elan snowmobiles to 10 ton terra-tired drop zone clearance vehicles), and with vehicles distributed in over 30 different locations throughout Canada (from Masset to Gander to Alert), the LCMM's job is one of the most diverse and most interesting in DGLEM.

Activities over the past year included the partial replacement of several fleets such as the LOSV Alpine snowmobiles which were replaced with new model Alpine IIs, and the old Bombardier half-tracks in Alert which were replaced with GT800s.

Last winter, visits were made to PETE, Nicolet and the North Warning System Site at Saglek, Labrador to investigate a number of problems with the commercial VB206s. These vehicles have unique problems due to their having the newer six cylinder Mercedes engine as opposed to the five cylinder model found in the older SMP fleet. The visits proved to be very rewarding and doubly beneficial as the information gathered was not only useful to the LCMM but also to NTV Project staff who will be procuring the newer six cylinder equipped vehicles.

One of the more interesting functions for the LCMM involves the review of new equipment and technology under the DGLEM "Buy and Try" Program. This program provides a means for LCMMs to procure and trial equipment to determine its potential for future fleet replacements or enhancements. At present the Marginal Terrain Vehicle Sub-section is sponsoring trials on the "SupaCat" all terrain vehicle, the "BR-200" tracked carrier, and the FinnCat "Flextrac SX" snowmobile. A further buy and try is being proposed for the trial of a "Track Truck" half-track vehicle in CFS Alert.

AVGP Grizzly Turret Depot Level Inspection and Repair (DLIR)

by CWO Hobbins

A contract has been signed with AV Technology Corporation of Michigan to produce a prototype, DLIR Grizzly turret. Depot Level Inspection and Repair (DLIR) includes 100% inspection and repair as necessary.

The program addresses the following areas:

a) a new electric traverse drive assembly;
b) improved fume extraction;
c) new gunner day/night sights;
d) new electrical harness;
e) new control boxes;
f) new turret basket and seat;
g) new gun cradle with outboard bearings and a new .50 cal mount;
h) new coaxial mount which will accommodate the C6; and,
j) new turret race ring.

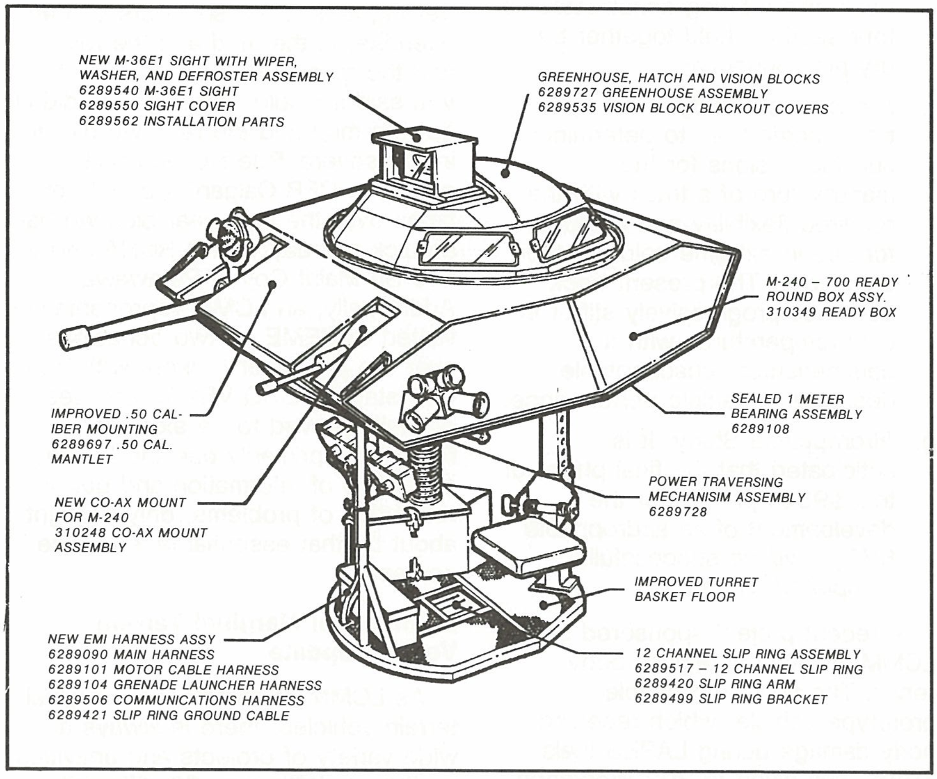
This program will use the improved and approved technology developed for the US Marine Corps Up Gunned Weapon Station (UGWS) 40/50 Turret which is also based on the Cadillac Gage 1 meter turret. The aim of the Canadian program is to address the long-standing operational deficiencies of the Grizzly turret and to improve its logistic support by establishing and maintaining commonality with another in-service fleet.

The prototype evaluation is well on its way with live fire testing to be conducted in the U.S. in the beginning of April of this year. Once this is complete, the turret will be brought back to LETE for toxicity testing and engineering evaluation. From there, it will be transported to CFB Gagetown for user evaluation.

In addition to AV Technology, a contract has also been signed with Cadillac Gage, the Original Equipment Manufacturer (OEM) of the Grizzly Turret, to conduct a similar program. This will allow us to compare the two products and ensure a better result for the operator.

It is hoped that a similar prototype of the 76 mm Cougar turret will be developed. Talks with the original manufacturer, Alvis of England, have been initiated. The extent of refurbishment has not yet been determined, and the decision to develop a Cougar turret prototype has yet to be taken. But that's another story ...

Arte et Marte


NEW M-36E1 SIGHT WITH WIPER, WASHER, AND DEFROSTER ASSEMBLY
6289540 M-36E1 SIGHT
6289550 SIGHT COVER
6289562 INSTALLATION PARTS
GREENHOUSE, HATCH AND VISION BLOCKS
6289727 GREENHOUSE ASSEMBLY
6289535 VISION BLOCK BLACKOUT COVERS
M-240 – 700 READY ROUND BOX ASSY.
310349 READY BOX
SEALED 1 METER BEARING ASSEMBLY
6289108
IMPROVED .50 CALIBER MOUNTING
6289697 .50 CAL. MANTLET
POWER TRAVERSING MECHANISIM ASSEMBLY
6289728
NEW CO-AX MOUNT FOR M-240
310248 CO-AX MOUNT ASSEMBLY
IMPROVED TURRET BASKET FLOOR
NEW EMI HARNESS ASSY
6289090 MAIN HARNESS
6289101 MOTOR CABLE HARNESS
6289104 GRENADE LAUNCHER HARNESS
6289506 COMMUNICATIONS HARNESS
6289421 SLIP RING GROUND CABLE
12 CHANNEL SLIP RING ASSEMBLY
6289517 – 12 CHANNEL SLIP RING
6289420 SLIP RING ARM
6289499 SLIP RING BRACKET

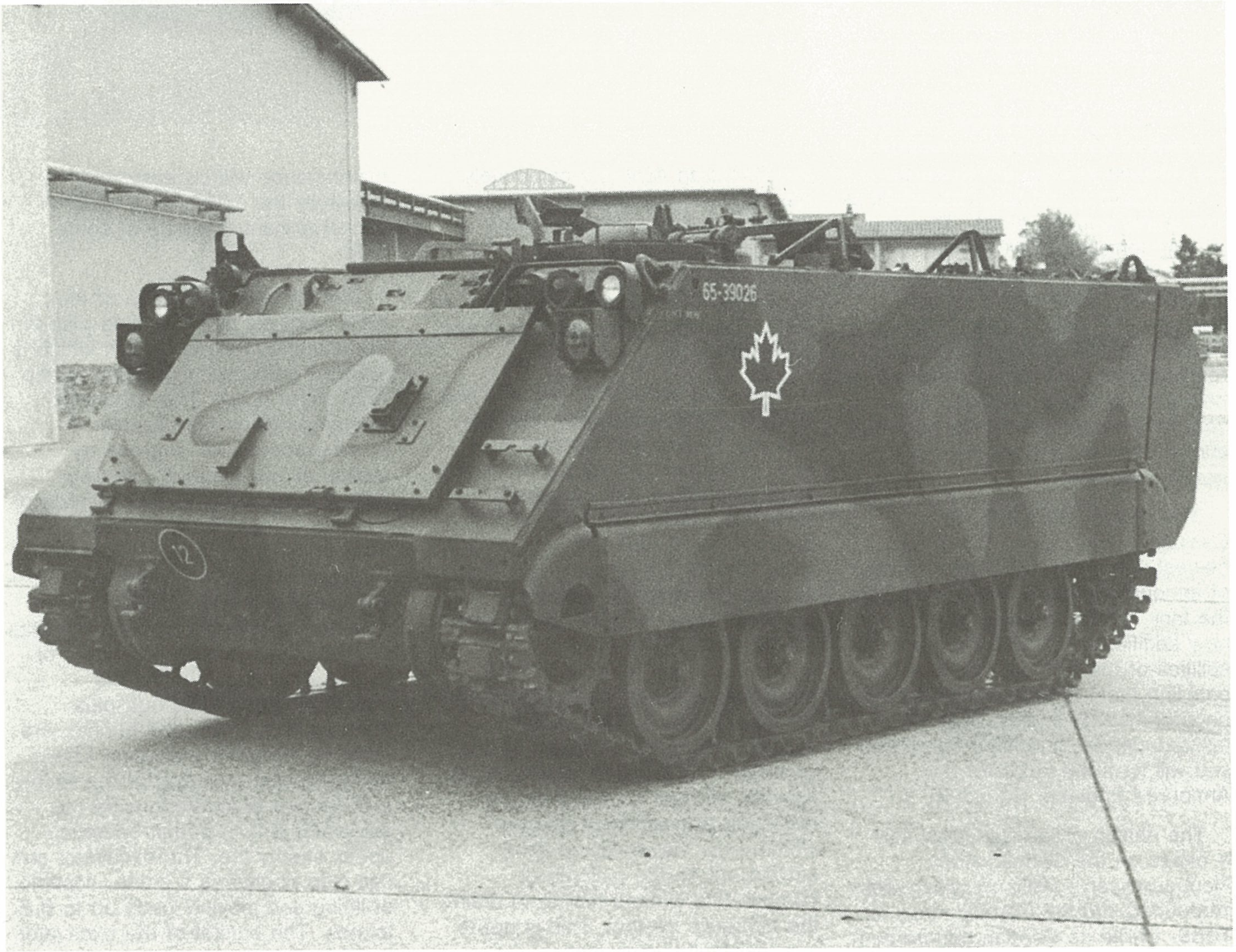
Silver Anniversary — M113 Family

There was a time when some Canadian Forces land equipment was thought to be a mobile museum due to its age or its technical or operational obsolescence. Such is not the case for the M113 family of vehicles. Even though this family has have been part of our inventory for 25 years, there is no question of replacement for at least another 15 to 20 years. With its continual facelifts, the M113 is considered the work horse of the world's major armies, and the production line is still going.

Since 1987, the fleet has undergone its first transformation from A1 to A2 versions, which entails modification of the suspension an improved cooling system, a new personnel heater and the installation of external fuel tanks. This major programme is under way at 202 Workshop Depot in Montreal, at M and M Manufacturing of Dartmouth, N.S. and by the American maintenance depot in Mainz, Germany. Production is running smoothly and the completion date is set for early 1992, earlier than projected.

In the next 5 to 8 years, we will be considering the conversion of part of the fleet from A2 to A3 versions, in order to meet the user's needs to counter new threats.

A silver anniversary is usually celebrated with a silver gift. We seriously considered a modification to mark the occasion, in the form of chrome road wheels on all M113s unfortunately, this modification was impossible to implement due to camouflage requirements. Who knows, maybe for the 50th anniversary...



The Armoured Engineer Vehicle

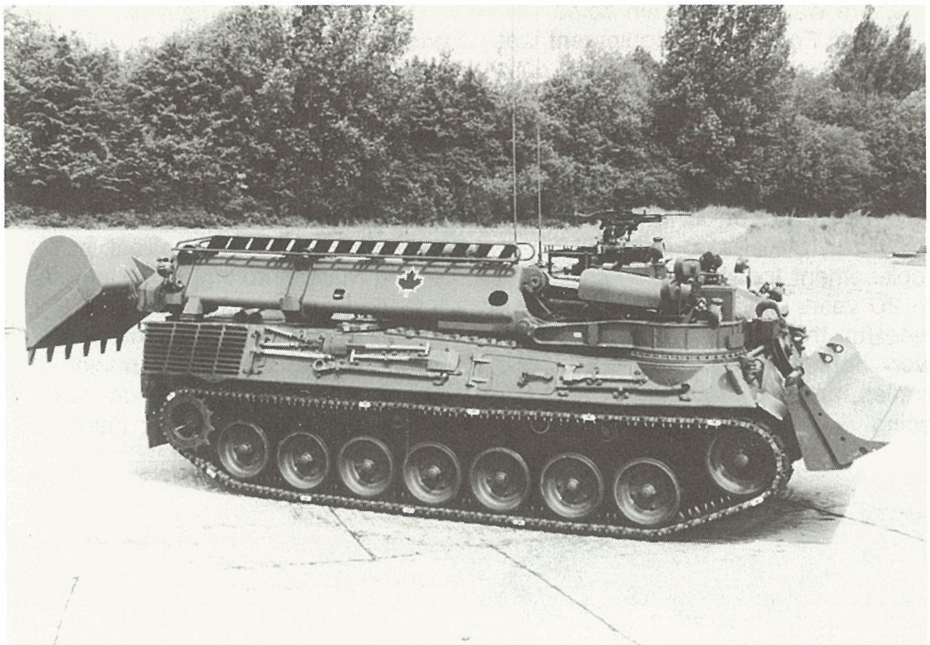
by DCMEM 3-2

In May 1989, vehicle No. 1 of the Leopard C1 Armoured Engineer (AEV) series rolled off the production line at Krupp MaK Machinenbau Gmbh in Kiel, Germany. This culminated nine long years of official staff work which commenced with the Statement of Requirement in 1981 and a number of years of work prior to that date is defining the requirement.

During the past year, the first vehicle was subjected to a variety of pre-determined tests and trials which it passed with flying colours. In February 1990, it was returned to the factory for re-build, final painting and load tests prior to the official Roll-out ceremony and handover of keys to RAdm D.R. Boyle, CEM, on 21 March. The series production of the remaining eight vehicles will be completed by Nov 90 and delivery of six vehicles to CFE and three to CFB Gagetown will be in progress as this article goes to press. The issue of four vehicles to 4 CER and two to 22 Fd Sqn will occur after the completion of the out-of-service operator and maintenance courses in October and November 1990. The remaining two vehicles in CFE will be held as Log Stock while the third vehicle in Gagetown will be used for annual operator and maintenance training courses.

The AEV or BADGER, its Canadian name, is the fourth and newest vehicle in the Leopard family of armoured vehicles which includes the tank, ARV and bridgelayer. This new addition will greatly enhance the abilities of the Combat Engineers by enabling them to accomplish mobility, counter-mobility and survivability tasks under fire and NBC conditions and will form the basis for an Armoured Engineer Squadron.

The design of the Canadian AEV is based on the German Army Pioneerpanzer 2 (PiPz 2) which was introduced into the German Army in 1989. Unlike its German counterpart which was built from ARV 2 chassis, the Canadian AEV is a completely new vehicle. Although at first glance it may look like a modified ARV, it incorporates a number of improvements while maintaining a large degree of commonality with the PiPz 2 and the other vehicles in the Leopard family.



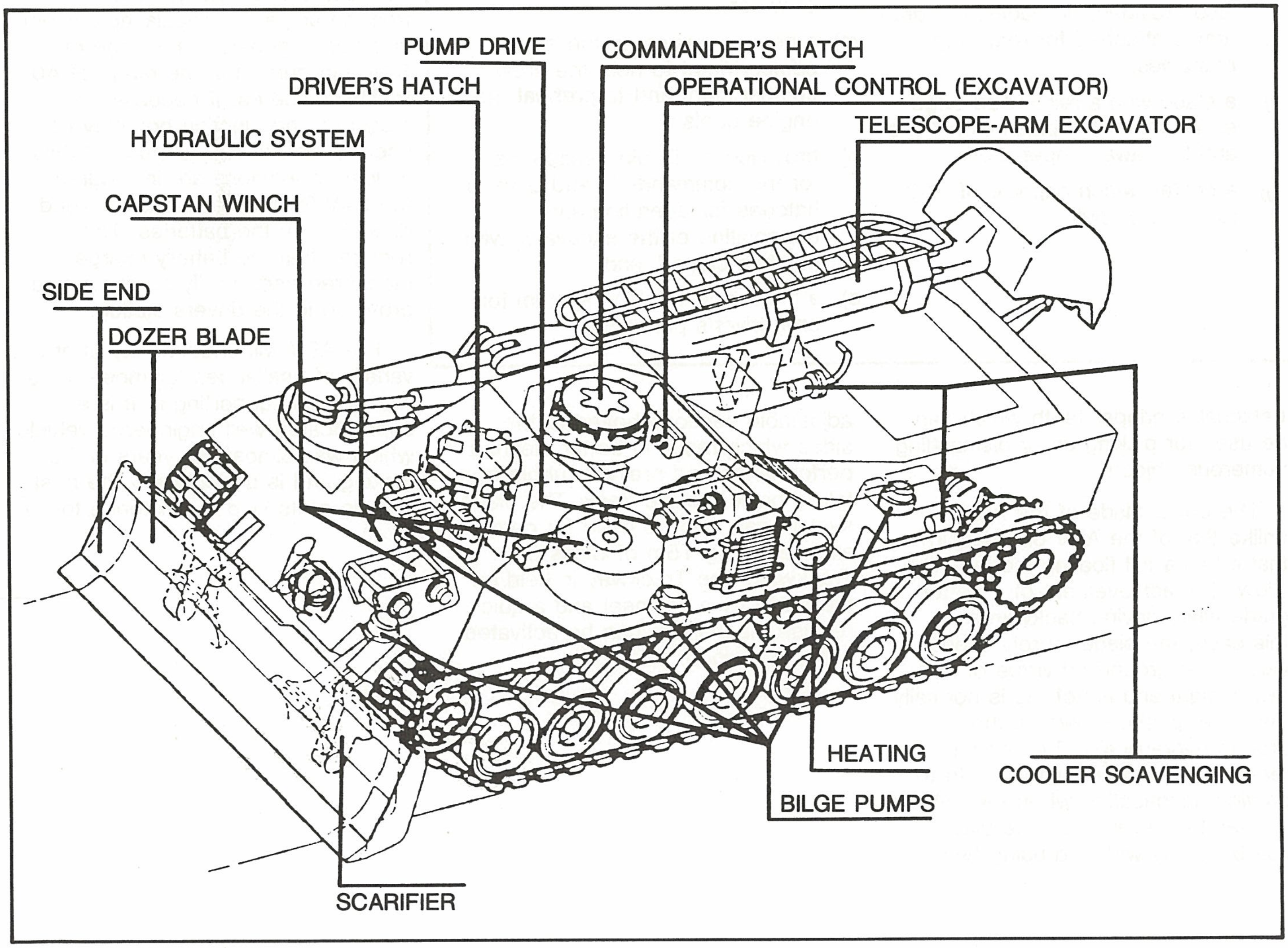
The main features of the AEV are a dozer blade, a capstan winch, a welding system and an excavator arm. The power for all but the welder is provided by a self contained hydraulic system operating at high pressure (315 bar) and high volume (520 1/min). The system includes six ring gear pumps, a maze of hydraulic lines cylinders and control valves and 420 litres of oil (300 of which are in the reservoir). Fault diagnosis, of what would otherwise have been a very complicated system, has been simplified by the provision of a number of test points. As well, all port connections are equipped with anti-leak devices which allow maintenance to be carried out on the majority of components without having to drain the hydraulic system. This is not to say that fault-finding and maintenance will be easy, but hopefully the 1000 page trouble-shooting manual will be of some help.

The excavating system of the AEV, consists of a swinging platform and attached excavator arm which is situated in the same location as the ARV crane boom. The excavator swinging platform is capable of rotating about 196 degrees by means of two hydraulic slewing cylinders from the transport mode (6 o'clock) to roughly 11 o'clock. The main working arc of the excavator is between 11 and 3 o'clock. The excavator arm is a modified commercial telescopic excavator with bucket. The excavating motions of raising, lowering, running the telescopic arm in and out, plus opening and closing the bucket, are done by hydraulic cylinders. The hydraulic lines, except for the swing cylinder are all located inside the excavator arm to permit operation under enemy fire. The excavator arm can also double as a crane, capable of lifting and moving loads up to 8.5 tonnes. The bucket of the excavator has been modified with two

Technical data of Armoured Engineer Vehicle

Length — Road Movement	8375 mm
Length — Cross-Country Movement	8925 mm
Width	3250 mm
Dozer Blade Extended	3750 mm
Height to Top Edge AAMG Mount	2570 mm
Ground Clearance	440 mm
Combat Weight	43,000 kg
Crew	3
Ground Pressure at Combat Weight	092 kg/cm^2
MLC	50
Performance at 2200 rpm (DIN 70020)	610 kW (830 hp)
Max. Speed at n=2200 rpm	62 km/h
Max. Gradeability	50%
Side Slope	30%

Vertical Wall	max. 0.90 m
Trench Crossing	max. 2.50 m
Fording	max. 1.20 m
Deep-Fording	max. 2.25 m
Underwater Operability with Deep-Fording Equipment	4.00 m
Dozing Capacity	270 m^3/h
Excavating Capacity	140 m^3/h
Excavator Pull Force	125 kN
Excavator Push Force	85 kN
Towing Force Main Winch	350 kN
Scarifying Depth	0.45 m
Dozing and Scarifying Speed	max. 8 km/h
Traverse Angle Excavator	196.5°
Tilt Angle Telescope-Arm	±60%



Characteristics of the A.E.V.

The AEV is an armoured vehicle on a Leopard 1 chassis which has been modified to permit the installation of a variety of engineer equipments, the AEV has the following characteristics:

a) a three man crew consisting of a commander, driver and sapper,

b) the commander is located rear and left of the driver and operates the AA machine gun, in addition he can operate the excavator when the vehicle is submerged,

c) the driver operates the driving controls, the clearing blade, the excavator and the winch,

d) the sapper operates the hull machine gun, the radios and may be employed for additional tasks on or away from the vehicle,

e) a telescopic excavator complete with bucket (a second smaller bucket for digging slit ternches is also provided), in addition, a grab arm is attached for removing obstacles,

f) a blade with a reinforced edge easily attachable blade extentions, and fold away ripper teeth,

g) a cpstan winch capable of 343 kilo-Newton pull,

h) an improved cutting and welding system powered from the vehicle generator,

i) a hydraulic system with electro-hydraulic controls and constant displacement pumps using a working pressure of roughly 300 bar,

j) an additional set of excavator operating controls for the commander, these are used during deep fording and underwater operations as well as remote control of the excavator and winch with the operator outside the vehicle,

k) an additional system to prevent clogging of the radiator while the vehicle is operated in the water and close to banks,

l) an increase in the number of bilge pumps in the crew compartment to decrease the risk in case of a sudden ingress of water,

m) a heating system in the engine compartment to heat the crew compartment and to preheat the engine coolant,

n) provision of tiltable periscopes for the commander's and driver's hatches for operation and observation of the excavator with hatches closed, and

o) a periscope washing system for one driver's periscope.

detachable gripper teeth which can be used for picking up or dismantling numerous objects.

The dozer blade of the AEV is unlike that of the ARV or AVLB in that it has a full floating mode which allows the achievement of a better grade while driving backwards. In this case, the blade merely glides across the ground by virtue of its own weight and is not, as is normally the case, pushed towards the ground hydraulically. Two ripper teeth are folded under the blade to provide scarification when the vehicle is operated in reverse. The blade can be easily widened using two adjustable sections bolted to the sides which result in better clearing performance and prevent rubble from falling back into the track. The blade system can also be used for carrying and deploying 15m of Class 60 Trackway. The Trackway is held on the blade by a chainset and a quick release mechanism can be activated using the winch.

Unlike the PiPz 2 which retained the ARV drum winch the AEV's main winch is a modern hydraulic capstan winch. The winch, its motors and cable storage are beneath the floor of the crew compartment. The 33mm diameter, 120m winch cable is drawn from the centre front of the vehicle. It has an effective length of 90m and is powered in and out using one of two gears. First gear has a ratio of 1:296, a speed of 16m/min and provides a maximum constant cable pull of 343kN. Second gear has a ratio of 1:41, a speed of 85m/min and a maximum constant pull of 47kN. This gives the AEV a constant maximum straight pull capability of 35 tonnes.

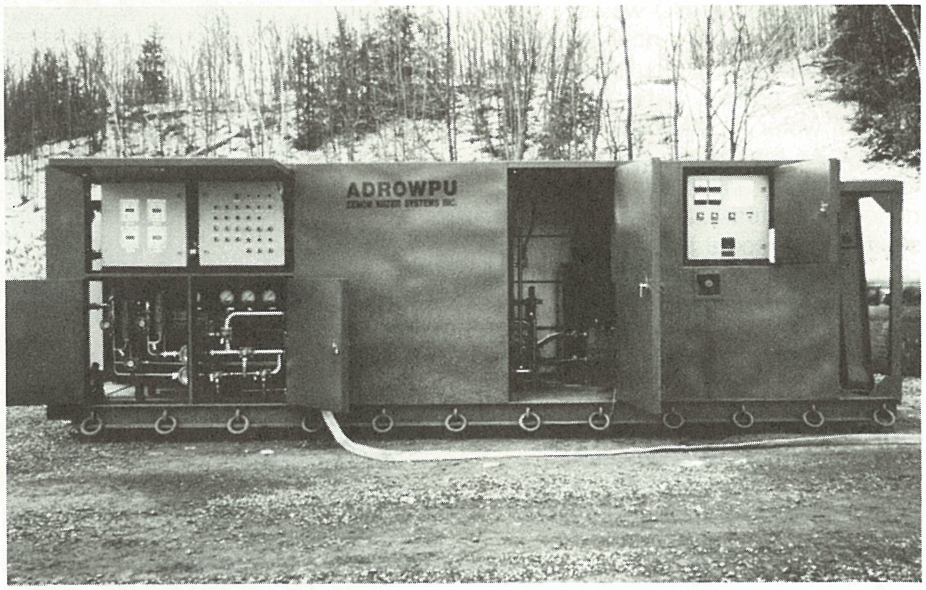
The cutting and welding equipment of the AEV is primarily intended for cutting concrete reinforcement and steel girders. For welding, the engine mounted generator which normally provides 24V DC to the vehicle, is temporarily disconnected from the 24V system and is connected to a voltage regulator from an amperage regulating system in order to generate a voltage of 54V and current in the range of 40 to 150 amperes. If necessary a plug-in at the junction box may be used to obtain 300 amperes. While welding operations are in progress, the 24V for the vehicle is obtained directly from the batteries. This requires that the battery charge be monitored periodically on the gauge provided in the drivers station.

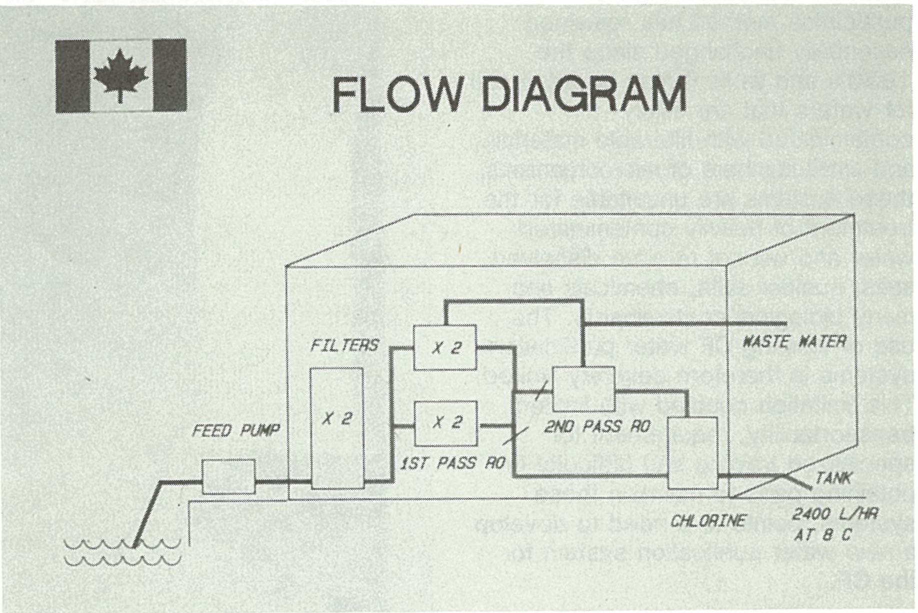
The AEV will undoubtedly offer a variety of challenges for those of us who will be supporting it. It is a sophisticated well engineered vehicle which was almost ten years in the making and is undoubtedly the best vehicle of its kind in existence today.

Development of a High Technology Water Treatment Capability for the CF

Capt M.J. Hauschild

Capt Hauschild is the Project Manager for the reverse Osmosis Development Project





With the largest fresh water supply in the world, Canadians take potable water for granted. Whenever a tap is opened, there is an expectation that the supply will be infinite. Few consider that beyond the tap there is a complex municipal water supply operation monitored and controlled by a battery of chemists, biologists and engineers. We take water supply for granted in the military as well. We can ill afford to do so.

During World Wars I and II, the Korean War and the Vietnam War, hospital admissions for disease were at least three times that of battle injuries. The greatest single cause of battlefield disease was the poor quality of water. The problem of disease would be no less today and in fact water quality standards have become more stringent and the range of potential contaminants has continually expanded. As existing water purification systems drift into obsolescence, Canada and other NATO allies have undertaken the development of a new water purification technology, Reverse Osmosis (RO).

Technology Description

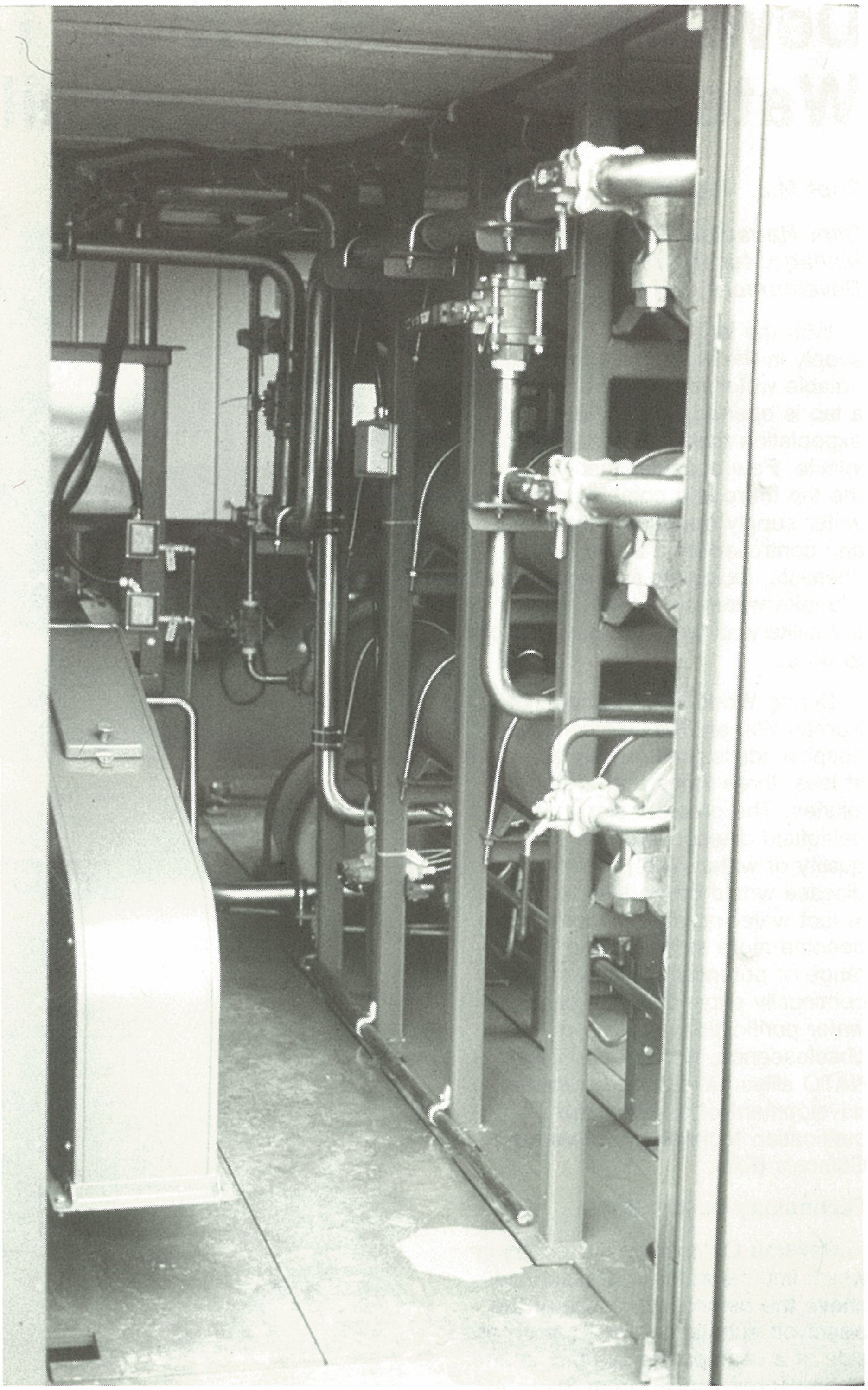
Reverse Osmosis is a process in which impure water is pressurized above the osmotic pressure of the dissolved substances present on one side of a semi-permeable membrane. At pressures varying from 30 to 40 BARS (400 to 600 PSI), pure water passes through the walls of this very thin plastic membrane leaving most soluble salts and particulate matter, such as microorganisms and suspended solids, behind.

The heart of any RO system is the RO element, a supporting structure for the very fragile membranes. These elements can be manufactured using a variety of materials and various design configurations. The challenge to the designer of elements and membranes is to maximize the surface area of the membrane in order to obtain the maximum output, while packaging the element in such a way that it is compact and able to withstand the high pressures to which the element will be subjected. The most common of these design configurations is the Spiral Wound membrane a design configuration where the membrane is applied onto layers of filler materials and wound up like a jelly roll. By manipulating the design of the RO elements and the rejection rate of the membrane, Reverse Osmosis systems can be designed for the specific requirements of the user and the quality of the available raw water.

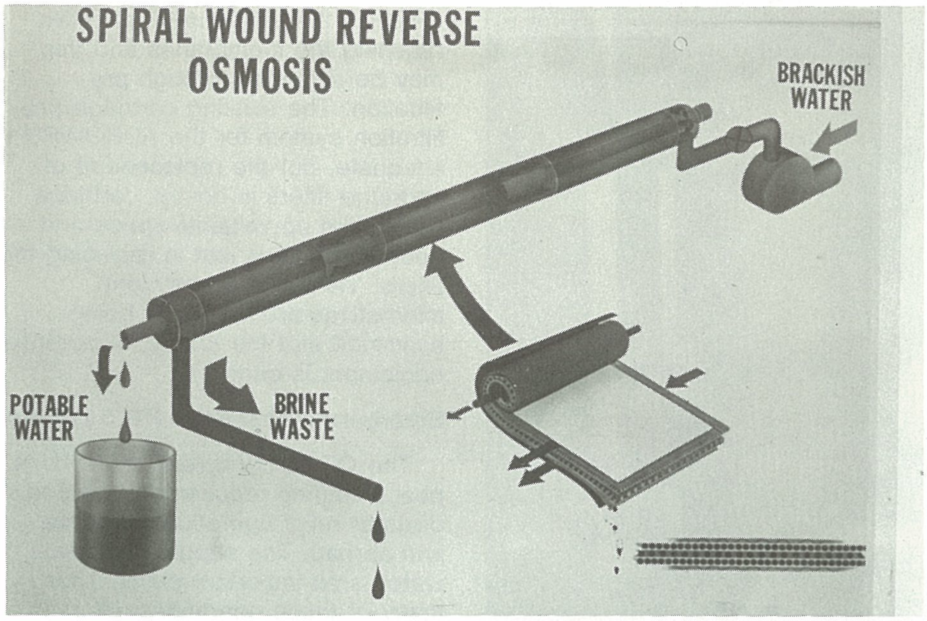
Reverse Osmosis systems are today widely used in industry for such applications as ultrapure water for the pharmaceutical and cosmetic industries, production of ultrapure water for dialysis, in the maple syrup industry to remove water from the sap and in the production of drinking water. Large scale RO water purification plants are now operating in Saudi Arabia and Southern Florida to produce potable water from backish water for the public water supply. As the technology continues to be refined, as environmental concerns increase and water quality standards become stricter, the range of applications for this technology will continue to expand.

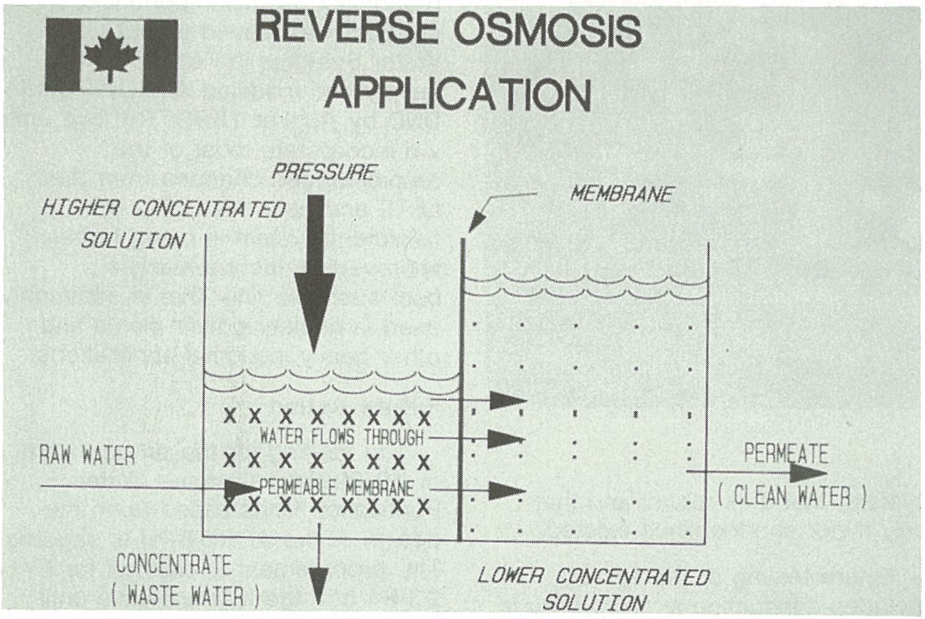
Military Reverse Osmosis System Requirement

DND currently has two conventional water purification systems in service, the No. 4 set and the 1500 GPH. Both systems employ filtration to remove suspended impurities and chlorination to kill microorganisms. This purification method has remained essentially unchanged since the 1930's and while it may be adequate for waters that are mildly contaminated with filterable materials and small numbers of microorganisms, these systems are unsuitable for the treatment of heavily contaminated water and will not remove dissolved salts, nuclear salts, chemicals and many biological contaminants. The use of existing CF water purification systems is therefore severely limited. This limitation coupled with limited transportability, requirement for specialized training and difficulty in obtaining parts to maintain these systems, points to a need to develop a new water purification system for the CF.



Most NATO forces now have Reverse Osmosis Water Purification Units (ROWPU's) in the field or in advanced stages of development. Although it might be desirable to purchase an RO system off the shelf, DND design criteria and the advanced state of Canadian technology, suggested that it would be advantageous to develop a Canadian ROWPU. Accordingly, a contract was issued in 1983 to MEMTEK Corp of Ottawa for the production of a prototype military RO system. The system was to be truck mounted and capable of purifying NBC contaminated water. Additionally, a single element benchtop system was purchased for laboratory testing. The prototype ROWPU was tested by the Land Engineering Test Establishment (LETE) in 1984 and while proving that the RO concept was sound, the system was not sufficiently robust to be field tested. Laboratory testing of the benchtop system was conducted by the Defence Research Establishment Suffield (DRES) and excellent results were obtained.




REVERSE OSMOSIS APPLICATION
PRESSURE
HIGHER CONCENTRATED SOLUTION
MEMBRANE
WATER FLOWS THROUGH
RAW WATER
PERMEABLE MEMBRANE
PERMEATE (CLEAN WATER)
CONCENTRATE (WASTE WATER)
LOWER CONCENTRATED SOLUTION

Development of the Air Droppable Reverse Osmosis Water Purification Unit (ADROWPU)

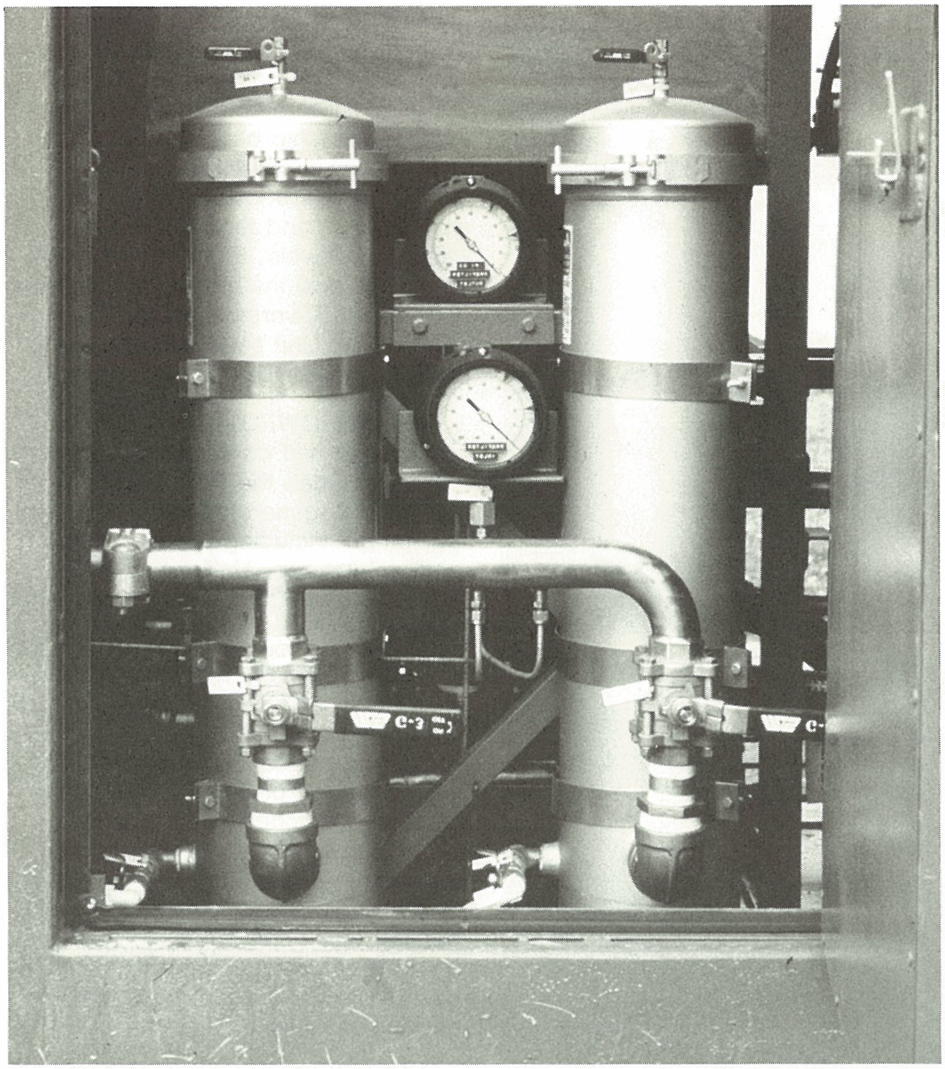
Based on encouraging laboratory data and promising estimates of field operational capability, a contract was issued to ZENON Water Systems Inc. of Burlington Ont. in July 1988 for the production of a second prototype. Rigid design criteria were imposed to ensure that it would be sufficiently rugged for use in the field.

The staff of DCMEM 4 established a solid and productive working relationship with the contractor through two innovative measures. Firstly, at the earliest design stage, ZENON engineers, DCMEM 4 staff and a DSS representative spent one week in Trenton and Petawawa to meet with air droppability experts, 2CER 1500 GPH operators and to observe the use of various equipment in the field. This opportunity provided the contractor with an insight into the requirement which could not have been gained otherwise. Secondly, DND and ZENON staff established a joint project team to optomize knowledge and experience and initiate a non-adversarial contractual relationship. The relationship between ZENON and DND was continuously reenforced through regular consultation and through visits by staff at all levels. Eight months from the signing of the contract, the Air Droppable Reverse Osmosis Water Purification Unit (ADROWPU) was delivered to DND.

The ADROWPU prototype is a completely self contained system which includes the RO process equipment, generator and all ancillary equipment including pumps, hoses and water tanks. Unlike the 1500 GPH, everything required to produce potable water is in one container.

The ADROWPU has an output of 2,400L/Hr under worst case conditions such as NBC contamination or sea water treatment and an output of 3,500L/Hr under less severe conditions is possible. The system achieves a very high contaminant rejection rate because of a double pass design which allows purified water to be passed through an additional RO element to guarantee that the water will be of the highest quality.

The system also includes some innovative portability features. It is the first piece of equipment to be permanently mounted on a Palletized Loading System (PLS) transportable container pallet and therefore does not rquire a dedicatd prime mover. It can be moved by any NATO PLS equipped vehicle and in Canada by the Kenworth and 10 Tonne Steyr Bridging Variant. The ADROWPU is designed to fit into a standard ISO container for rail and sea transport and is air transportable using the CC130. The system has been designed to be air droppable using both the Low Altitude Parachute Extraction System (LAPES) and by Low Velocity drop, however, an air drop has not yet been attempted.



System Testing

Following the DND acceptance of the ADROWPU in March 1989, the system was sent to LETE for functional tests and evaluation. The scope of the LETE trials was to confirm that the system met all of the requirements of the specification and to report on the effectiveness of the system for use in the field. The LETE trials were successfully completed in May 1989 and the system was shipped to Camp Wainwright for RV 89.

The second phase of testing was done during RV 89 and consisted of a user trial by 2 Combat Engineer Regiment (2CER). This user trial was to confirm user satisfaction with the equipment, to ensure that the system is sufficiently rugged for field use and to identify any design shortcomings. The 2CER trials demonstrated that users require minimal training to operate the system, that it as robust and that only minor shortcomings existed.

Future testing of the system includes conducting air drop trials in Spring/Summer 1990 and conducting various pre-treatment tests during FU 90/91.

Design Improvements

Two major improvements to the ADROWPU prototype are planned. The first is to approximately double output by adding additional elements and to improve the efficiency of the system. The second is to modify the pre-treatment system. Pre-treatment is the most common problem in RO equipment. Reverse Osmosis membranes are very effective in rejecting dissolved substances and suspended materials but they are easily fouled by various suspended matter and this necessitates an automated chemical washing of the elements. The challenge is to minimize the suspended materials reaching the membranes and this may be achieved through pre-filtration. The existing cartridge pre-filtration system for the ADROWPU is adequate, but the replacement of cartridge filters is costly, cartridge filters take up valuable space and operating time is lost in replacing the filters. Various pre-treatment alternatives are presently being examined and the testing of potential equipment is ongoing.

Emergency Response RO Systems

The CF respond regularly to U.N. peacekeeping requirements and to disaster relief operations at home and abroad. The supply of potable water is an important element for many of these operations. In recognition of this importance, a contract was issued to ZENON Water Systems in Feb 1990 to supply two modified ADROWPU's to DND by August 1990. The two units will incorporate most of the recommended changes from the LETE and user trials. The pre-treatment system is being further improved by incorporating a backwashable filter that is commonly used in nuclear power plants and other heavy industrial applications.

Future Action

The staffing for the procurement of 18 Reverse Osmosis Water Purification Units based upon the design of the ADROWPU is ongoing. The procurement is planned for FY 93/94 and the time available until then will be used to refine the existing system design through consultation with NATO allies, industry and an ongoing test and evaluation program.

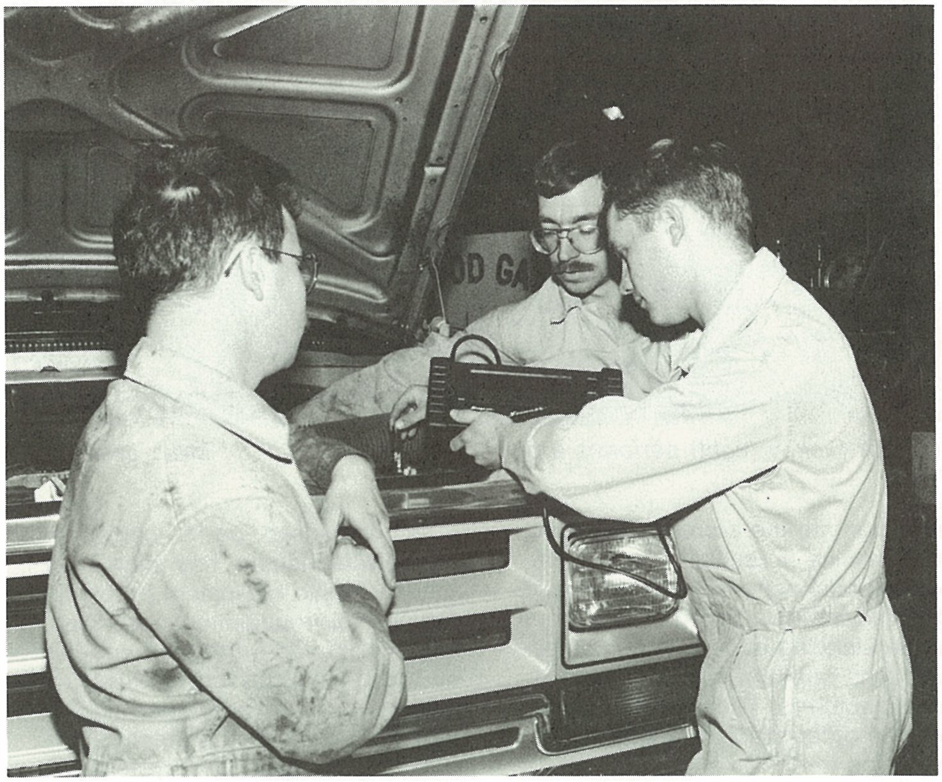
Conclusion

With the growing emphasis on environmental and health concerns, technologies like Reverse Osmosis will play an increasingly important role. Water is a resource upon which we depend to survive and cannot be taken for granted. Current efforts to develop a Reverse Osmosis water purification capability will ensure that the CF can provide water that meets the highest quality standards, anywhere in the world.

FROM AIR COMMAND

We Have the Technology...
Vehicle Computer Systems

by Captain T.X. Yaworski BEMEO
CFB Greenwood



CFN DC Patey, Cpl FJ Miller and Cpl KA Hickey (left to right) using an engine diagnostic analyser.

In today's workshop when a problem occurs with a newer commercial pattern vehicle how often have you heard "Send it downtown, must be the black box!", probably more often than you can remember. Why is that? Are today's commercial vehicles too advanced for our technicians? If you answered "Yes" I am certain you are one of the vast majority. Surprisingly, from first hand experience we have discovered this is not true. This article will outline our findings and offer suggestions to change our perceptions of black box maintenance.

With today's commercial vehicles using on-board computers to control ignition and fuel injection the diagnosis of faults has become more complex. To meet stringent pollution and fuel economy standards, manufacturers have employed electronics to operate engines at their peak efficiency and improve drivability. The engine computer receives approximately a dozen inputs from various sensors, makes a few hundred calculations per second and outputs instructions to control fuel and ignition systems. The computers are not overly complex by today's standards but the conditions underwhich they operate can cause problems. Overall, this technology has improved the efficiency, performance and reliability of today's vehicles.

The lack of familiarity with this technology by our technicians has created a void in our capabilities. Although presently restricted to commercial pattern vehicles this deficiency will eventually affect all major equipments including SMP vehicles. Vehicle manufacturers design today's drive trains with on-board computers as an integral component. As SMP fleets are replaced and funding restricted, procurement programs wil be forced to buy off-the-shelf vehicles as is evident with our 5/4 Ton and CUCV fleets. Further, this technology will be used in equipment ranging from fire crash trucks, Snow and Ice Control equipment to Auxiliary Power Units. No longer will engine computer systems not be a major maintenance factor in field units.

Fortunately we already possess the most important resource required to maintain this technology, our technicians. With the proper training and tools we have discovered the black box in today's vehicles is no longer mystical. With persistence and hard work BEME in CFB Greenwood successfully obtained out-of-service training courses for seven vehicle technicians from four Atlantic AIRCOM bases in March 1990. The training was conducted at the Nova Scotia Institute of Technology in Halifax. Two General Motors designed courses for civilian mechanics were given. These were a one day Introduction to Computer Systems intended for mechanics unfamiliar with computerized fuel systems. This include on-board system diagnostics and computer controlled components and systems, common to today's electronic Fuel Injection course. This contained operation and diagnosis of all fuel systems including computer input sensors and computer controlled outputs such as emission systems, fuel control, spark control, idle control and converter clutch control. The students gained hands on experience using shop manuals to

Cpl KA Hickey (right) performs a diagnostic test with Cpl FJ Miller assisting.

demonstrate the correct diagnostic and service procedures on current commercial pattern vehicles. These technicians now have a basic understanding of vehicle computer systems common to all manufacturers. With further training on the other major manufacturers systems the basic skills and knowledge would be acquired with minimal training time. The development of these skills require hands on experience.

Upon return to their workshops, these technicians were prepared to apply their new found skill and knowledge but were faced with the ongoing dilemma in the EME Branch. Presently no engine diagnostic tester capable of tapping into today's engine controls and other systems is held in the EME workshop. With the demise of the Autosense, no replacement has been obtained to keep pace with advancing technology.

In comparison, on the civilian side the vehicle industry has addressed the diagnostic equipment problem by basing their requirements on three basic tasks. First, they tap into the on-board computer system using adapters, probes and those giant multi-pin diagnostic connectors. Second, the diagnostic systems allow the technician to call up service information to help make sense of the data collected. Finally, the diagnostic analyzer or computer, depending on the complexity of the equipment, tries to help with diagnostics. The data is examined and improper readings are identified. Defective components are pin-pointed and recommended corrective action advised. Considerable expense and effort is being expended by the major automotive manufactures designing systems with the information storage capability to analyze all types of inputs and provide indepth diagnostic help — one that can mimic the complex reasoning and experience of a trained technician. This equipment will be in dealerships in the next couple years and demonstrates the complexity and advances in diagnostic equipment. However, the cost and specialization of this equipment, make it unfeasible for our applications.

Presently several companies in the aftermarket offer inexpensive handheld analyzers that can identify defective sensors and recommend corrective action. These use replaceable data modules which can be continually updated. These analyzers cost approximately $2,000 and as they can be used on the major domestic manufacturer's vehicles and are very easy to use they are very cost effective. This equipment is being pursued locally. The acquisition of a diagnostic analyzer will provide the technician with the opportunity to train and become conversant in computer systems for a relatively minimal expenditure. The formerly mystical black box, which is surprisingly the most reliable part of these systems, can be serviced in our workshops. The majority of problems occur with the vast network of sensors, wires, and activators that connect the black box to the rest of the vehicle.

The increasing application of on-board computers in all types of vehicles and equipment cannot be ignored. The present void in our workshops capabilities to service this technology can be addressed. From the interest demonstrated, especially at the junior technician level, any training opportunities are viewed very positively. With introductory training and up-to-date diagnostic analyzers this void can be overcome. Skill and experience can be developed through hands-on practice.

The future application and complexity of on-board computers will continue to grow. We must address this trend by providing our technicians with the training and tools to keep pace. The vehicle technician trade must evolve with today's technology. "Sending it downtown" should be an alternative not our only recourse.

FROM CFCC

Communication Command Update

In the last update on Communication Command, you may have realized that I was almost living in my suitcase. Now six months later, I can tell you that my travelling was reduced considerably as to attend the EME Commander Course and to work on:

a. an "Aide Mémoire" on land maintenance for the Communication Reserve Units as to help the reserve vehicle and radio technicians to perform their job more easily;

b. the Maintenance Policies and Directives for Communication Command; and

c. the draft Statement Of Requirement (SOR) for the Material Support Equipment (MSE) facilities of CFS Alert.

In the next six months, I am planning to visit CFS Alert at least once and CFS Masset, and continue my work on the "Aide Mémoire", the Maintenance Policies and Directives and the draft SOR for the MSE facilities of CFS Alert.

CFS Alert will probably be visited a second time because of the introduction of two full tracked crash fire rescue vehicles, ECC 140307. These vehicles will replace the present ECC 140307 CFR 76-25216 and ECC 140329 CFR 82-47760. These new ECC 140307 have been build under contract by Waltek Co of Montreal and the vehicle portion sub-contracted to Bombardier Inc. As of the beginning of January, one vehicle has been delivered to LETE Ottawa and the second is scheduled for mid-January. Both vehicles will be tested in the cold chamber and used for close to 100 hours as to deliver two fully operational vehicles. Also, training will be held in Alert by Companies' representatives.

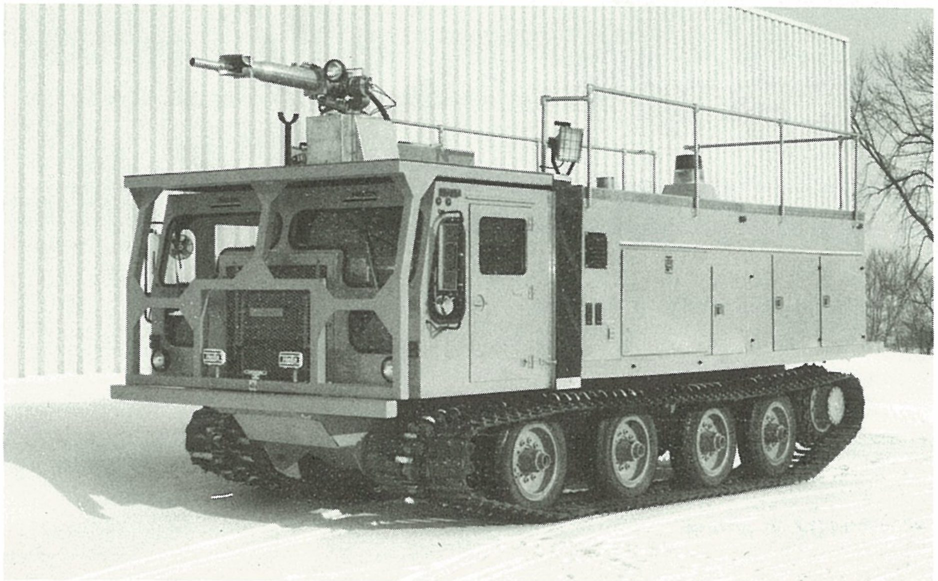
Arte et Marte.

Claude Turmel
Captain
SO Maint L

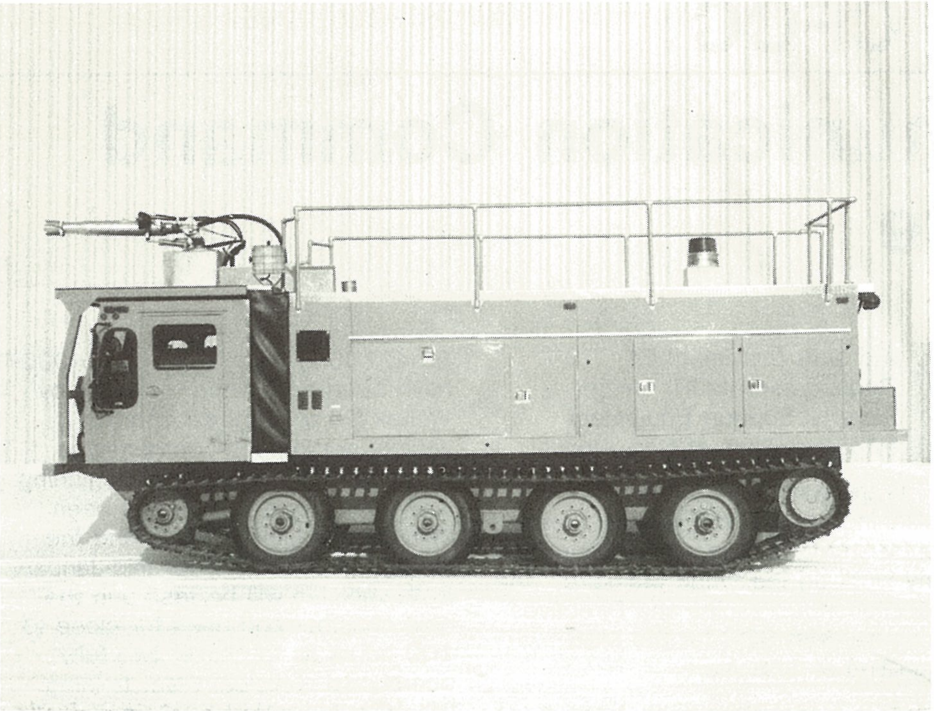
New Crash Fire Rescue Vehicle for CFS Alert

In 1990, CFS Alert will receive two new crash fire rescue vehicles to replace the two vehicles used at the moment. These last vehicles are:

a. One ECC 140307 (now ECC 189107) which is an air transportable crash fire rescue vehicle, full tracked, CFR 76-25216. This vehicle has the following characteristics:
    (1) Make: Flex Track Nodwell,
    (2) Model: CF-110FF,
    (3) Year: 1976,
    (4) NDID: 32333,
    (5) EMC: B06,
    (6) Waterfoam Capacity: 2400L, and
    (7) Dry Chemical Capacity: 225 Kg; and



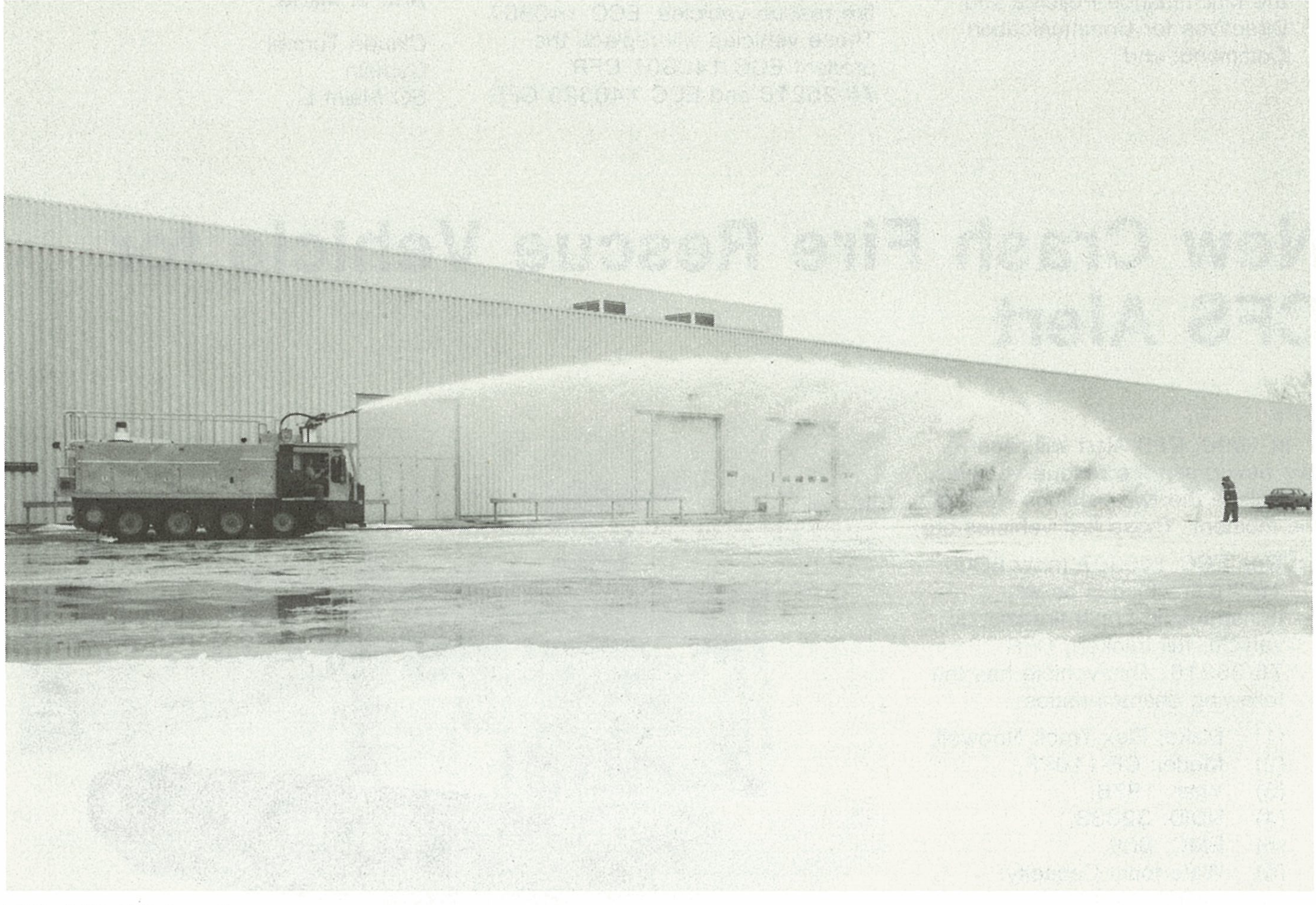
Left Front View of ECC 189107



Left Side View of ECC 189107

b. One ECC 140329 (now ECC 189129) which is an air transportable (after removal of both axles) truck, fire fighting, rapid intervention, 4x4, with arctic kit, CFR 82-44760. This vehicle has the following characteristics:

(1) Make: Walters,
(2) Model: R2000,
(3) Year: 1982,
(4) NDID: 32325,
(5) EMC: B26,
(6) Water Capacity: 2000L,
(7) Foam Capacity: 250L,
(8) Dry Chemical Capacity: 204 Kg,
(9) Engine: Detroit Diesel 8V92T, 400 HP,
(10) Transmission: Allison HT 750 DRD Automatic,
(11) Speed: Design Cruising Speed 112 Km/h,
(12) Shipping Weight: 9280 Kg,

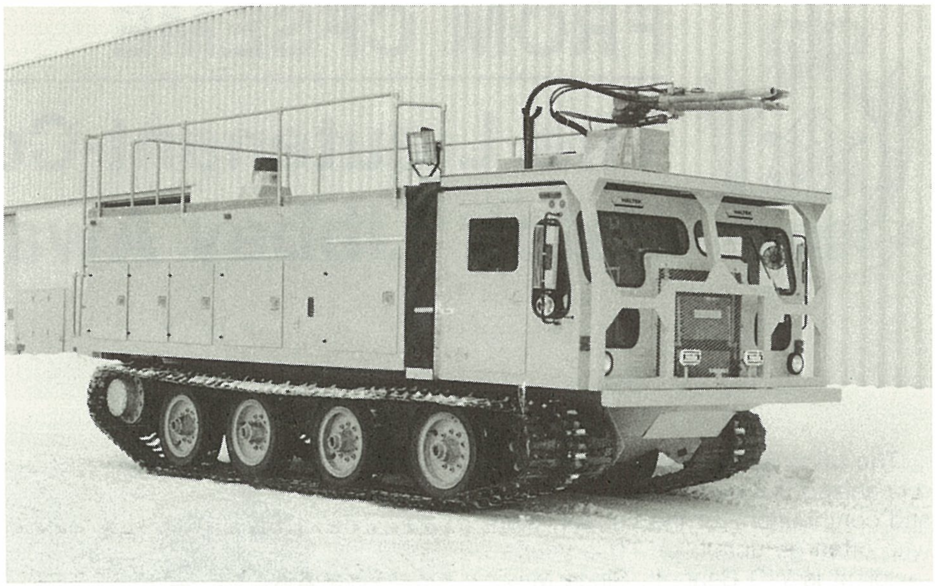


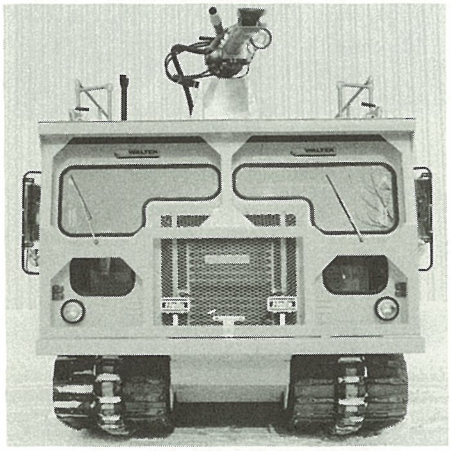
ECC 189107 in action

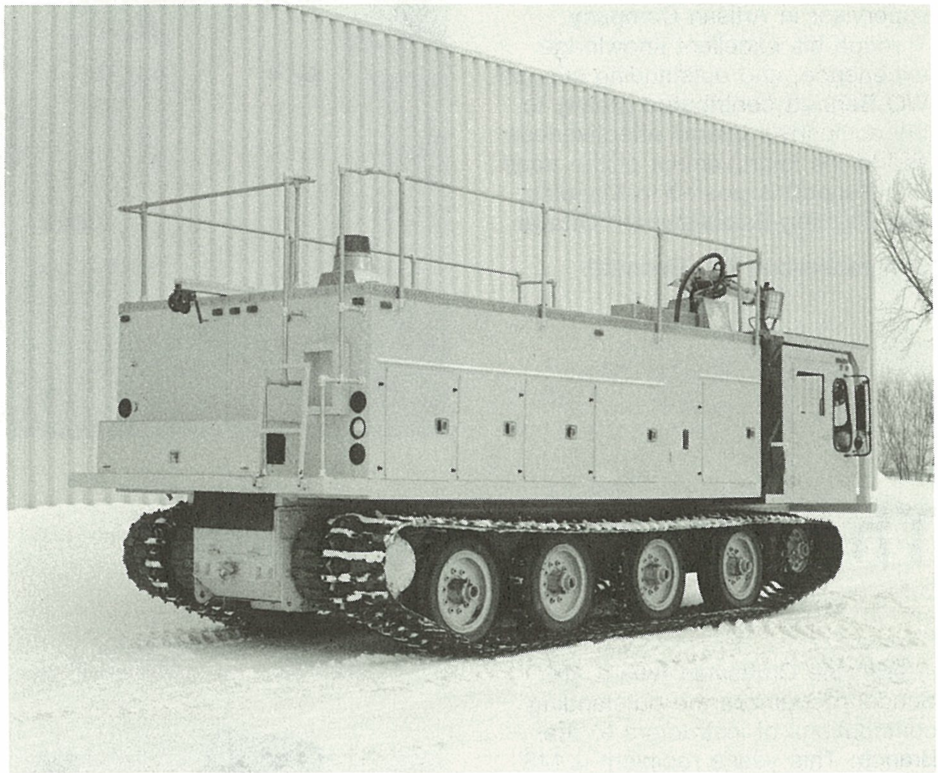
(13) Pay Load: 2410 Kg,
(14) Overall Length: 6860 mm,
(15) Overall Width: 2440 mm, and
(16) Overall Height: 3606 mm.

The new crash fire rescue vehicles are scheduled to reach Alert by August 90. These vehicles are:

a. two ECC 189107 which are air transportable crash fire rescue vehicles, full tracked, CFR 89-85542 and 89-85543. These vehicles have the following characteristics:
   (1) Make: WALTEK INC/GO-TRACT (Bombardier);
   (2) ECC: 189107,
   (3) Year: 1989,
   (4) NDID: 32A64,
   (5) EMC: B06,
   (6) Engine: Detroit Diesel 6V92TA, 360 HP,
   (7) Transmission: Allison HT-740D Automatic,
   (8) Max Speed: 47 KM/H,
   (9) Shipping Weight: 15,517.38 Kg (34,210 LBS),
   (10) Pay Load: 2,658 Kg (5860 LBS),
   (11) Overall Length: 7366 mm (24 FT 2 IN),
   (12) Overall Width: 2616.2 mm (8 FT 7 IN),
   (13) Overall Height: 3175 mm (10 FT 5 IN),
   (14) Reduced Height: 2463.8 mm (8 FT 1 IN),
   (15) Water Capacity: 2750L,
   (16) Foam Capacity: 475L,
   (17) Foam Reach: 50292 mm (165 FT),
   (18) Dry Chemical Capacity: 226.8 Kg (500 LBS), and
   (19) Dry Chemical Reach: 30480 mm (100 FT).


Right Front View of ECC 189107


Front View of ECC 189107


Right Rear View of ECC 189107

Claude Turmel
Capt
CFCC HQ/SO MAINT

FROM CFSEME

The Lieutenant-Colonel Ralph Libbey Award

The LCol Ralph Libbey Award recognized the tremendous effort and contributions of the support staff who often go unnoticed. This year's recipient is WO Bennett. Since May 1985 WO Bennett has been an instructor and FCS training cell supervisor in Artisan Company. Through his excellent knowledge, experience, and outstanding support WO Bennett contributed greatly to the company's overall effectiveness and to the improvement of the trade. WO Bennett is posted to Mapping and Charting Establishment Ottawa.

Congratulations WO Bennett!

The Craftsman Award

With the Craftsman Award, the School recognizes the outstanding contributions of instructors to the Branch. This year's recipient is MS Mulack.

MS Mulak has been an instructor in CFSEME EOD Section since July 1988. He is an extremely dedicated instructor spending many extra hours diagnosing and repairing the Remote Mobile Investigator (RMI), and improving the training of students. MS Mulak is posted to Fleet Diving Unit Shearwater.

Congratulations MS Mulak!

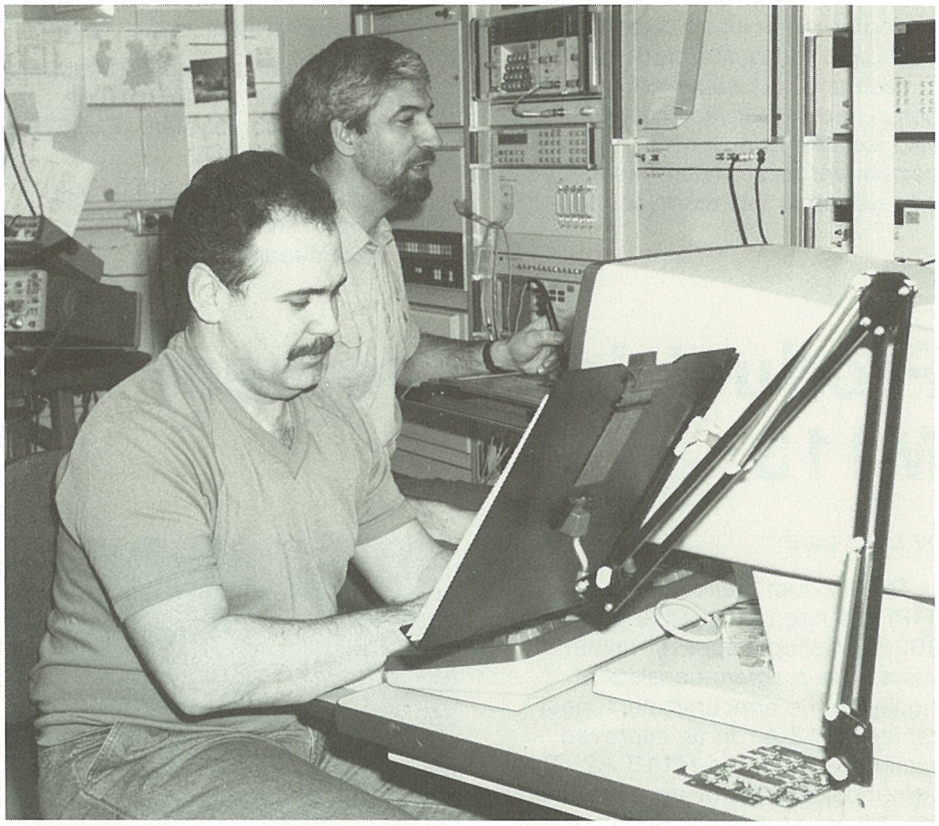
Automated Test at 202 Workshop Depot

by Capt D.B.S. Perrin

The ATS 1000 is a highly complex set of test equipment capable of automatically testing circuit boards for faults down to component level. Outside Original Equipment Manufacturing organizations, this system is unique in the Canadian Land Forces. The ATS 1000 was purchased by DLAEEM in August 1985 at a procurement cost of approximately $1,000,000.

Just what is automated test? Put simply, automated test is electronic testing controlled by a computer, as opposed to having to do all of the tests by "hand". The computer will place test equipment, such as voltmeters, oscilloscopes, or frequency counters, at appropriate points on the circuit board under test, along with the requisite voltage and signal sources, and read outputs from predefined test points. This data is then compared to previously established standards to determine if the circuit board is within tolerances, or if a problem exists. If a problem exists, a series of tests is initiated to discover the source of the fault, and a reporting procedure records all relevant data.

Testing circuit boards using automated test equipment has inherent advantages and disadvantages. Automated test has the capability to test extremely quickly. As an example, to completely test the Display Board of the MILIPAC by traditional "hand" methods, a technician would have to spend a solid work week of effort. Using the ATS 1000, it is possible to test the same board in much less than an hour, translating to a savings in time of approximately 5000 per cent. All tests are repeatable, and the system can be programmed to maintain relevant maintenance data which could be useful in identifying trends of failures in a fleet of circuit boards. The major disadvantage, however, is cost. A system with a start-up cost of approximately $1,000,000 and an overhead cost of providing facilities and trained technicians is very expensive. In the case of 202 Workshop Depot, however, these costs are already covered, making the ATS 1000 a very attractive alternative to Original Equipment Manufacturers for projects wishing to take advantage of automated test.


Mr. Chouinard and Mr. Lamarche testing a printed circuit board using the ATS 1000.

When the ATS 1000 system was purchased, Hewlett Packard was contracted to develop software test sets and adapter hardware to enable the testing of the two MILIPAC circuit boards and three of the circuit boards of the AN/UGC 74 Teletype system. Two technicians were trained on the use of the equipment, and the necessary programming skills to modify existing software test sets.

Training has continued to the point that the two technicians are now able to write software test sets for any digital, analog or hybrid circuit board of moderate complexity. Training is currently scheduled to enable the technicians to program the software for more complex circuit boards, including those with microprocessors.

Recently, however, 202 Workshop Depot's expertise was put to the test with an in-house programming challenge. The two technicians were tasked to program the AN/PRC 515 radio system's circuit boards. The Logic Board was attempted first, as it was completely digital. Programming took less than three months, and the test will isolate faults down to component level on the board. The next challenge was to do a more complex board that mixed both digital and analog sections into a hybrid system. The Logic Transmit Board was chosen and was successfully completed in four months, and can also isolate faults down to component level. Much experience was gained in this exercise, and 202 Workshop Depot's capabilities in this area have increased dramatically.

The programming of the software test sets of the AN/PRC 515 radio system boards has generated quite an interest in 202 Workshop Depot's Automated Test facility. Lately, taskings have been received to enquire as to the capability to complete the following programming tasks:

a. verifying, using automated test, all of the (remaining) AN/PRC 515 radio system circuit boards;
b. verifying, using automated test, all of the Field Artillery Battery Communication System (FABCS) circuit boards; and
c. verifying, using automated test, all of the AN/TRQ 503 radar system circuit boards.

With the ATS 1000 system in place, and two technicians well trained, the Automated Test facility of 202 Workshop Depot is indeed a centre of expertise, and is quickly becoming indispensable to the Land Maintenance System. Questions on automated test can be directed to the Project Manager, ATS 1000, 202 Workshop Depot, and are very much encourged.

The day of simple electronics has passed, and it is facilities such as 202 Workshop Depot which will face the challenges of supporting an ever more complex fleet of weapons systems, with the aid of the ATS 1000 and the Automated Test facility.

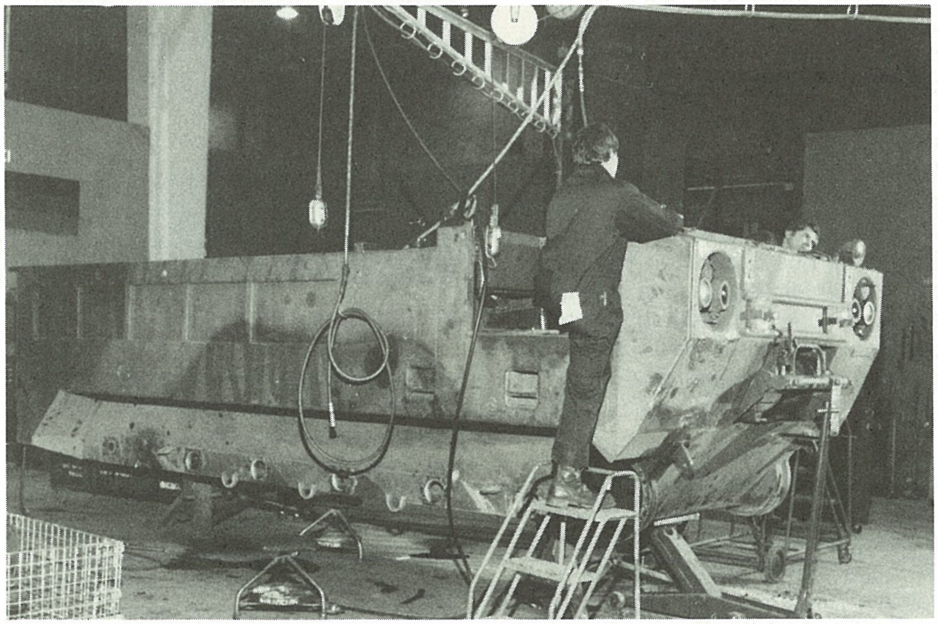
Arte et Marte.

Product Improvement Program (PIP) M113

by Lt B. Lord

The Product Improvement Program (PIP) has been an integral part of 202 Workshop Depot for many years. The program consists of modifying the armoured personnel carrier M113 A1 in an improved version which is the M113 A2. The main modifications being done during the PIP are as follows: improvement of the cooling system, the suspension and the installation of new external fuel tank. 202 Workshop Depot also does some outstanding modifications and repairs to everything related with safety problems.

The preparation for the PIP requires hard work and everyday adjustments in order to help this program become more efficient each year. When a vehicle arrives, it is inspected and stripped of its components which are washed and then forwarded to different work centers. The vehicle itself, after being stripped and washed, is sent to the Welding Shop where the modifications to the hull are made so that it can receive the external fuel tanks, the suspension and the improved cooling system. The hull is then moved to the assembly work center, where, all the components await it after being repaired. When assembled the vehicle is then verified by quality control and sent back to its unit.

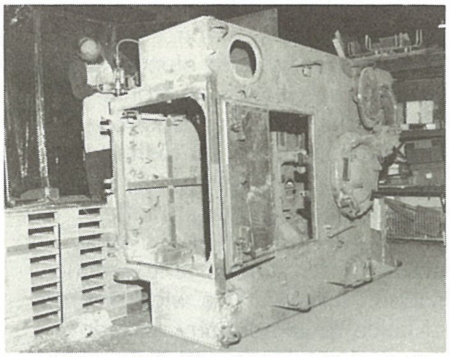


Two technicians removing all the parts of a cargo vehicle before sending them throughout the shop for repair.

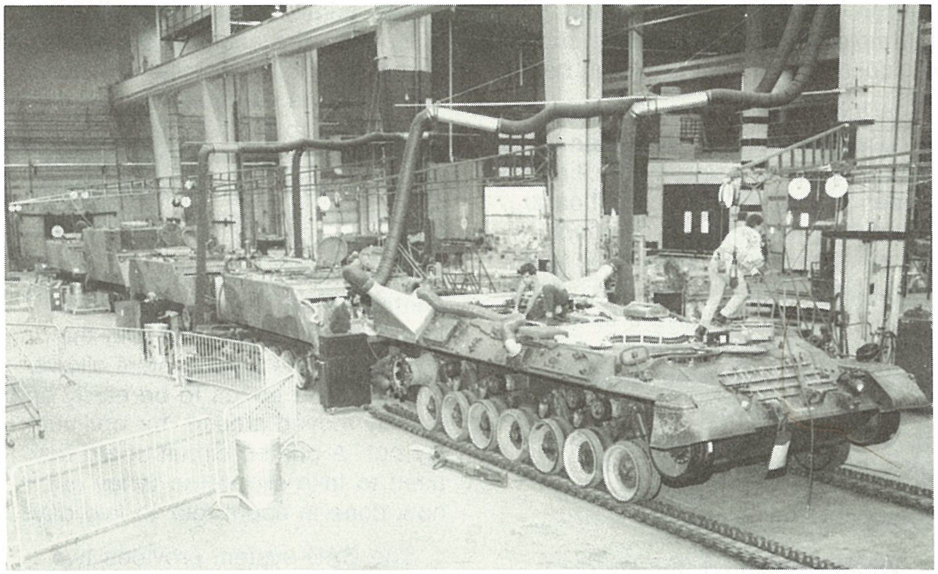
During the last few years, some modern technological methods of control helped 202 Workshop Depot and the PIP to be more efficient. For example, the complexity of working with different types of vehicles one after another being a cargo, a command post an ARVL etc., has

CWO Simard verifying, with the help of the computer system, the work that will be scheduled for the next few weeks.

MCpl Bernard Duchesneau entering in the bar code system the equipments that are being sent to another work center.



A technician working on the suspension modification with the APC hull on its side.



The assembly line of 202 Wksp Dep at the end of the Leopard program and at the beinning of the M113 PIP.

created some problems. To overcome these problems, the development of a bar code system was introduced. This system helped the production by stating the location of each part of the vehicles in the shop at any given time. Another method of control used by 202 Workshop Depot is a sophisticated computer system, which provides the supervisor and the foreman with an accurate detail of their work and an accurate forecast for the next few weeks, depending on their priority.

The introduction of those systems helped the PIP tremendously. As a matter of fact, since the last few years the number of M113 improvement has not ceased to increase. In 1988 we completed 58 vehicles, 66 in 1989 and the forecast for this year is 75. The credit does not go entirely to the system, but to the people as well who make this program more efficient and effective, without them we would be useless. I would like to say that the PIP is coming to an end in two years, but the future looks good for 202 Workshop Depot. There will always be challenges and we will be able to meet them.

Lt B. Lord

FROM LETE

The Role of Computers in Design and Production

by Major A.R. Beveridge OC E Squadron LETE

E Squadron LETE is more correctly known as the Land Tactical Electrical and Armament Engineering Squadron. Its role is to provide engineering test and evaluation and development and design services to the forces. Most of the work is done for the army, but we do work for the air force, navy and common support elements as well.

The design and development function accounts for approximately 85% of the work load of 170 projects at any time. Work is done in the fields of general electrical engineering, fire control systems, communications, electro-optics, communications and electronics systems installation, systems evaluations including Electro-magnetic interference testing and armaments engineering. To produce the engineering designs and prototypes for the various tasks, the squadron has a large engineering support division. The wide diversity of fields requires many different types of machines and processes.

To try to streamline the design and prototype production process, the squadron is making the maximum use of computer aided engineering, design and production. A good example of this is the design and production of a printed circuit board.

In the old days (only three years ago) an engineer or technician would design a circuit using a pencil and paper. He would then breadboard the circuit and make component substitutions until it performed as required. He would then correct his circuit diagram and give it to the mechanical design section, who would lay out a printed circuit board pattern, by manually placing mylar tape on a sheet of paper. This is a slow process and it might take six weeks to lay out a complicated board.

When completed, the lay out would be photographed to produce a working tool for the production of the printed circuit board. The photograph negative would be used to expose the light sensitive resist to allow for the etching of the circuit traces. It would also be used as a guide for the manual drilling of the required holes. A typical printed circuit board will have 2,000 holes and require four days to drill.

This method has inaccuracy built into all of the steps and many wasted boards are produced because of equipment inaccuracies and human error. The time from initial design to finished printed circuit board might be three to four months and this is only for the initial prototype which often is redone several times before it is the best solution to the problem.

The computer age has brought us many advantages. Now the engineer or technologist uses a computer aided engineering system to design his circuit, rather than a pencil and paper. The system is a PC AT type or a 386 based system. The system allows for rapid substitution of parts, as all available parts are detailed in the computer's "library". The circuit file is then used by a simulations program, so the designer can see the response of the circuit without building it. Many errors are easily corrected quickly here and parts are easily changed, even if the part is not in stock.

The printed circuit board can be laid out by the engineer's computer if it is simple, but normally the information is electronically transferred to the Mechanical Design Section's Computer Aided Design (CAD) system. This is a Intergraph Corporation system running on a VAX II mini computer, using dual screen graphics terminals. Here the printed circuit board is laid out by the mechanical designer and the computer. The CAD system allows for parts and traces to be easily and quickly moved around, for optimum lay out. A printed circuit board that used to take six weeks to lay out is now done in about four to five days.

The CAD system provides two outputs. One is a computer file which is electronically transferred to a commercial company for the production of a photo plot. This system uses a computer driven laser to exposure the photographic film to very high accuracies. The negatives are then returned to E Squadron for the etching of the traces.

The second output is used by our Numerically Controlled Driller/Router. This machine drills the required holes in the printed circuit board and cuts the board out of the stock material. The machine can drill two boards at the same time, and does a 2,000 hole board in about two minutes, a little bit faster than the manual method's four days. Accuracy is greatly improved with hole location being correct to within one-thousandth of an inch.

The end result is that a priority printed circuit board can be done in one to two weeks, from initial design to production of the prototype, instead of three to four months. The power of the systems used have allowed for much more complicated circuits and printed circuit boards. The largest board made to date is 18 inches by 25 inches, with double sided traces and approximately 200 integrated circuits. This type of board would have been very difficult or impossible to make if all of the old techniques were used.

Computers have allowed E Squadron to produce prototypes in shorter time, in greater accuracy and that are more technically complicated to meet the operational need. They are being used in all of the fields that we work in, for design, data collection, training, production of prototypes and final report production. As additional systems come on line, we will be able to transfer our prototype designs to 202 Workshop Depot or industry for production quantities. DND has entered the modern age and we are attempting to make the maximum use of the available technology.